February 16, 1959

Aviation Week

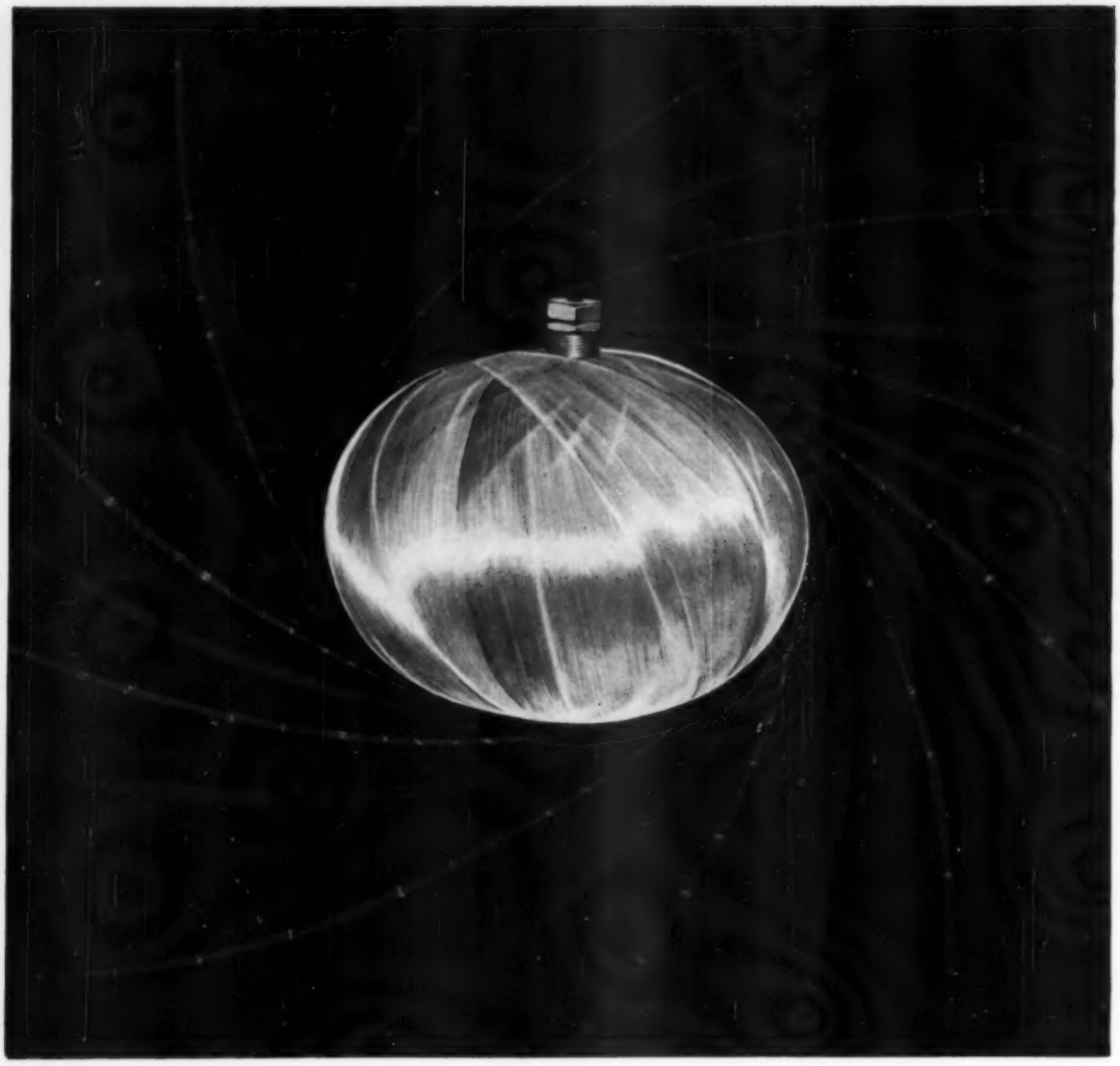
Including Space Technology

A McGraw-Hill Publication

Survey Shows Computer Market's Size

Vickers Vanguard

How Chrysler Produces Jupiter IRBM



HOW HIGH THE PSI? (BRUNSWICK "BOTTLES" UP TO 200,000)

Here's the big news in the pressure vessel field. Brunswick's new, unique Strickland "B" Process (SBP) now results in filament-wound plastic vessels with the greatest strengths ever obtained. At the same time, vessel weights have been drastically pared down. Brunswick can create vessels (from that shown above to air bottles and rocket motor cases) with these specifications: Hoop stress values in the range of 175,000 to 200,000 psi. Burst strength values: up to 150,000 psi. Weight: 20 to 40 per cent *less* than that of *any* previously built plastic vessels. Temperature limits: up to 600° F. Super tough SBP vessels are also ideal for components that must stand up to extended operating cycles, and can be mass produced in compound and monocoque shapes.

For proposed or existing projects involving pressure vessels, Brunswick offers skillful assistance in the design, development and fabrication stages. For more details concerning the higher strength–lower weight advantages of SBP components, write or call: The Brunswick-Balke-Collender Company, Defense Products Division Sales Manager, 1700 Messler St., Muskegon, Michigan.

BRUNSWICK

MAKES YOUR IDEAS *WORK*

From Goodyear Engineering Leadership–

4 major advances in aviation tires

1. ANNOUNCING – DURABOND BALANCING! Patented new Goodyear process with exclusive grit-blasting equipment ensures lasting adhesion of balancing compound *inside* the tire – perfect balance *outside*. Self-curing compound dries to smooth, even finish – will not flake, peel, crack or deteriorate – becomes an integral part of tire.

2. NEW REINFORCED RETREADING! Through the use of fabric-reinforced treads – and thanks to its long experience in making high-speed fabric tires for the military – Goodyear is now qualified to retread jet airliner tires to *new tire specifications*. Rigid quality control, extensive testing and expert tire engineering – available only when you retread tires *at the factory* – assure complete dependability.

3. COMING – GIANT DYNAMOMETER capable of speeds to 320 mph, with auxiliary equipment to 500 mph. Representing an investment of nearly $2 million by Goodyear, dynamometer will be the most advanced in the industry – providing exact data that will qualify tires for the highest-performance aircraft of the foreseeable future.

4. ASSURED – OPTIMUM PERFORMANCE by most exacting quality-control measures that pretest bead steels, rubber compounds, body cords – *all* materials that go into Goodyear Aviation Tires. This million-dollar facility evaluates all materials for their individual characteristics and compatibility with other components – during production and after products are finished.

WRITE TODAY for detailed information on these significant new developments. The address: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

AVIATION PRODUCTS BY

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MORE AIRCRAFT LAND ON GOODYEAR TIRES, WHEELS AND BRAKES THAN ON ANY OTHER KIND

59-4

the farther the "reach" the more critical precision becomes

Today's missiles demand tight accuracy because a ten-thousandth of an inch functional error can cause failure to reach the target a continent away. And when you're reaching toward a target almost a quarter of a million miles away, precision becomes even *more* critical!

Ex-Cell-O is in the accuracy business, meeting today's unprecedented demand for precision by building into every part, every assembly, every machine tool an exactness that the aircraft industry has counted on for higher, safer, faster flying for 40 years.

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Aircraft Division

AVIATION CALENDAR

Feb. 17—Special Winter Meeting on Human Survival in Space, American Astronautical Society, New York Academy of Sciences, New York, N. Y.

March 3-5—1959 Western Joint Computer Conference, sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Assn. for Computing Machinery, Fairmont Hotel, San Francisco, Cal.

March 5—Operation and Maintenance Clinic, Atlanta, Ga. Cosponsors: Airwork Corp. and Southern Airways.

March 5-6—Flight Propulsion Meeting (classified), Institute of the Aeronautical Sciences, Hotel Carter, Cleveland, Ohio.

March 5-7—Western Space Age Conference and Exhibit. For information: Domestic Trade Dept., Los Angeles Chamber of Commerce, 404 South Bixel St., Los Angeles 54, Calif.

March 6—Air Transport Command Reunion, World War II Officers, Waldorf Astoria, New York, N. Y.

March 8-11—Gas Turbine Power Conference and Exhibit, Netherlands-Hilton Hotel, Cincinnati, Ohio. Sponsor: American Society of Mechanical Engineers.

March 9-12—Aviation Division Conference, American Society of Mechanical Engineers, Statler-Hilton Hotel, Los Angeles.

March 10-11—Third Annual Shock Tube Symposium, Old Point Comfort, Ft. Monroe, Va. For details: Armed Forces Special Weapons Center, Kirtland AFB, Albuquerque, N. M. Attn.: SWRS R. R. Birnkoff.

March 12—Symposium on Microwave Techniques for Computing Systems, Department of Interior Auditorium, Washington, D. C. Sponsor: Information Systems Branch, Office of Naval Research.

March 16-17—Conference on the Nuclear Optical Model, Florida State University,

(Continued on page 6)

AVIATION WEEK Including Space Technology

February 16, 1959

Vol. 70, No. 7

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2. Machined metal case for retention of accuracy, especially under high temperature and/or humidity.
3. Metal inserts in molded wiper hubs for positive wiper positioning, for accuracy under shock, vibration, acceleration.
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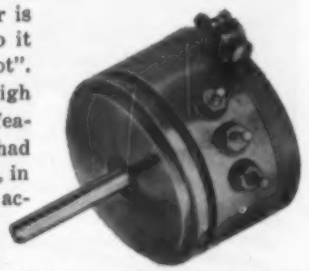

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AVIATION CALENDAR

(Continued from page 5)

Tallahassee, Fla. Sponsors: National Science Foundation, Office of Naval Research, Air Force Office of Scientific Research/Nuclear Physics Division. (Publication of conference proceedings is anticipated.)

March 16-20—11th Western Metal Exposition and Congress, American Society for Metals, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif.

March 23-25—Flight Testing Conference, American Rocket Society, Daytona Plaza Hotel, Daytona Beach, Fla.

March 23-26—National Convention, Institute of Radio Engineers, Coliseum and Waldorf-Astoria Hotel, New York, N. Y.

March 25-27—16th Annual Conference, Pacific Coast Section of the Society of the Plastics Industry, Hotel del Coronado, San Diego, Calif.

March 31-Apr. 2—Polytechnic Institute of Brooklyn's Ninth International Symposium, Subject: Milliameter Waves, Auditorium, Engineering Societies Bldg., New York, N. Y.

March 31-Apr. 3—National Aeronautic Meeting, Society of Automotive Engineers, Hotel Commodore, New York, N. Y.

Apr. 2-3—Conference on Electrically Exploded Wires, sponsored by the Thermal Radiation Laboratory of the Geophysics Research Directorate of the Air Force, Cambridge Research Center, Somerset Hotel, Boston, Mass.

Apr. 5-10—1959 Nuclear Congress, Municipal Auditorium, Cleveland, Ohio. For information: Engineers Joint Council, 29 West 39th St., New York 18, N. Y.

Apr. 7-10—1959 Welding Show and 40th Annual Convention, American Welding Society, International Amphitheatre and Hotel Sherman, Chicago, Ill.

Apr. 12-19—Air Force Assn.'s World Congress of Flight, Las Vegas, Nev.

Apr. 18-22—Annual Meeting American Society of Tool Engineers, Schroeder Hotel, Milwaukee, Wis.

Apr. 21-22—Spring Technical Conference on Electronic Data Processing, Cincinnati Section of the Institute of Radio Engineers, Engineering Society Bldg., Cincinnati, Ohio.

Apr. 22-24—1959 Annual Meeting, Institute of Environmental Engineers, LaSalle Hotel, Chicago, Ill.

Apr. 30-May 1—Controllable Satellites Conference, American Rocket Society, Massachusetts Institute of Technology, Cambridge, Mass.

May 4-6—National Aeronautical Electronics Conference, Institute of Radio Engineers, Biltmore Hotel, Dayton, Ohio.

May 4-7—Fifth Annual Flight Test Instrumentation Symposium, sponsored by the Instrument Society of America, Seattle Section, Olympic Hotel, Seattle, Wash.

May 5-7—Spring Meeting, International Scientific Radio Union, Willard Hotel, Washington, D. C.

May 6-8—Seventh Regional Conference and Trade Show, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.

June 12-21—23rd French International Air Show, Le Bourget, Paris, France.

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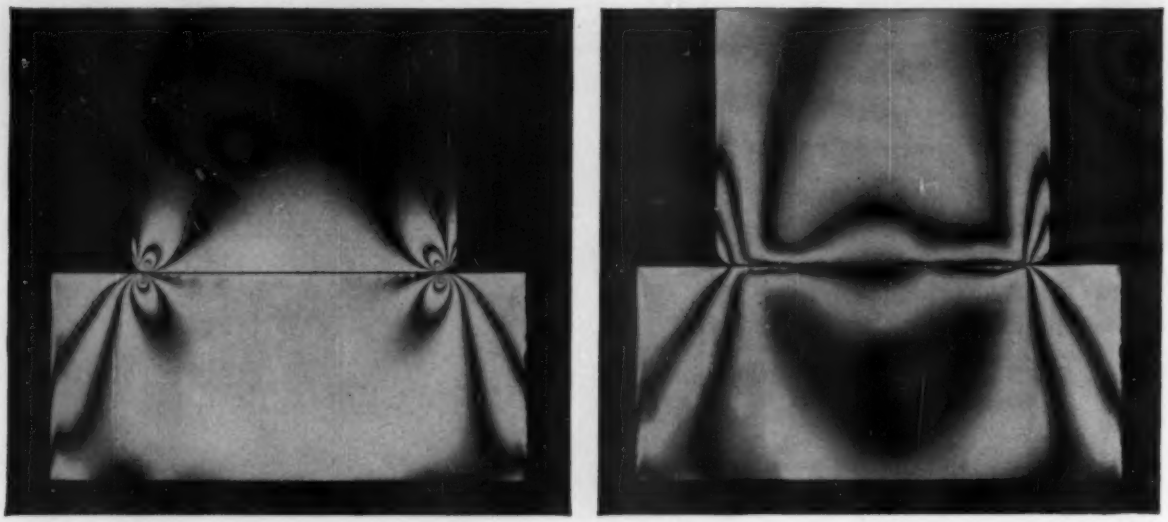
BEARING BRIEFINGS

One in a series of technical reports by Bower

ROLLER BEARING LIFE AND CAPACITY LINKED TO STRESS DISTRIBUTION



These reproductions of photoelastic studies contain important evidence for every engineer and designer concerned with the performance and selection of roller bearings. In these photographs, the alternate dark and light areas, called fringes, indicate not only the magnitude of stress but also the stress distribution. The photographs were taken by Bower Research Engineers during a study of stress distribution in roller bearings.

The subjects represent rollers and raceways of two roller bearings under identical loads. The illustration at the left shows a roller of conventional design. The illustration at the right shows a Bower "Profiled" roller. That is, the roller is precision ground with a large radius generated along the body of the roller—a predetermined and controlled distance from each end.

The conventional roller photo (left) clearly shows how, under load, stress concentration builds up in and near the roller ends. This is called edge-loading. Such areas of concentrated stress are the breeding grounds for metal fatigue and eventual bearing failure.

In the photo of the "Profiled" roller (right) stress lines can be seen uniformly distributed across the whole length of the roller and raceway. There are no points of excessive stress concentration, consequently no starting points for early fatigue. Such a "Profiled" roller exhibits a great advantage in improved load carrying capacity, a most important bearing requirement.

Under actual operating conditions, Bower "Profiled" roller bearings show a considerably longer life at higher speeds and under greater loads than conventional roller bearings.

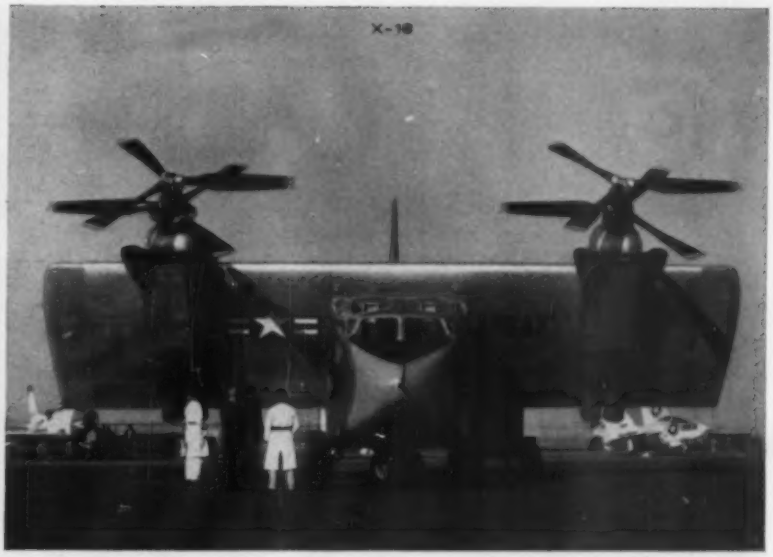
Because of this, and of other Bower features to be discussed in later technical reports, we suggest that you consider the advantages of Bower bearings in satisfying your future bearing requirements.

★ ★ ★ ★

Bower engineers are always available, should you desire assistance or advice on bearing problems. Where product design calls for tapered roller bearings or journal roller assemblies, Bower makes these also in a full range of types and sizes.

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION — FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICHIGAN



HILLER

class of ***1959***

This year new approaches to vertical flight are taking form and shape at Hiller. But what may often seem bold innovation actually is the next logical step evolved from years of experience in developing ideas into working aircraft. Because Hiller Aircraft is a major producer of helicopters, and because Hiller keeps a critical, discerning eye on many hundreds of its own ships in daily use, innovation is always tempered with the realities of production.

12E — New work horse of commercial helicopters, the 12 E is by far the most powerful in its class.

H-23D RAVEN — Dependable, multi-mission helicopter for the U. S. Army. Ask anyone from Camp Wolters about the "D."

X-18 — Dramatic new concept in air transports — the Air Force's VTOL/STOL Tilt Wing.

XROE-1 — Lightweight and collapsible, the ROTORCYCLE is now in production for tests by U. S. Marines.

IDEAS ARE ONE THING. DELIVERIES ANOTHER. BOTH COME FROM HILLER AIRCRAFT CORPORATION

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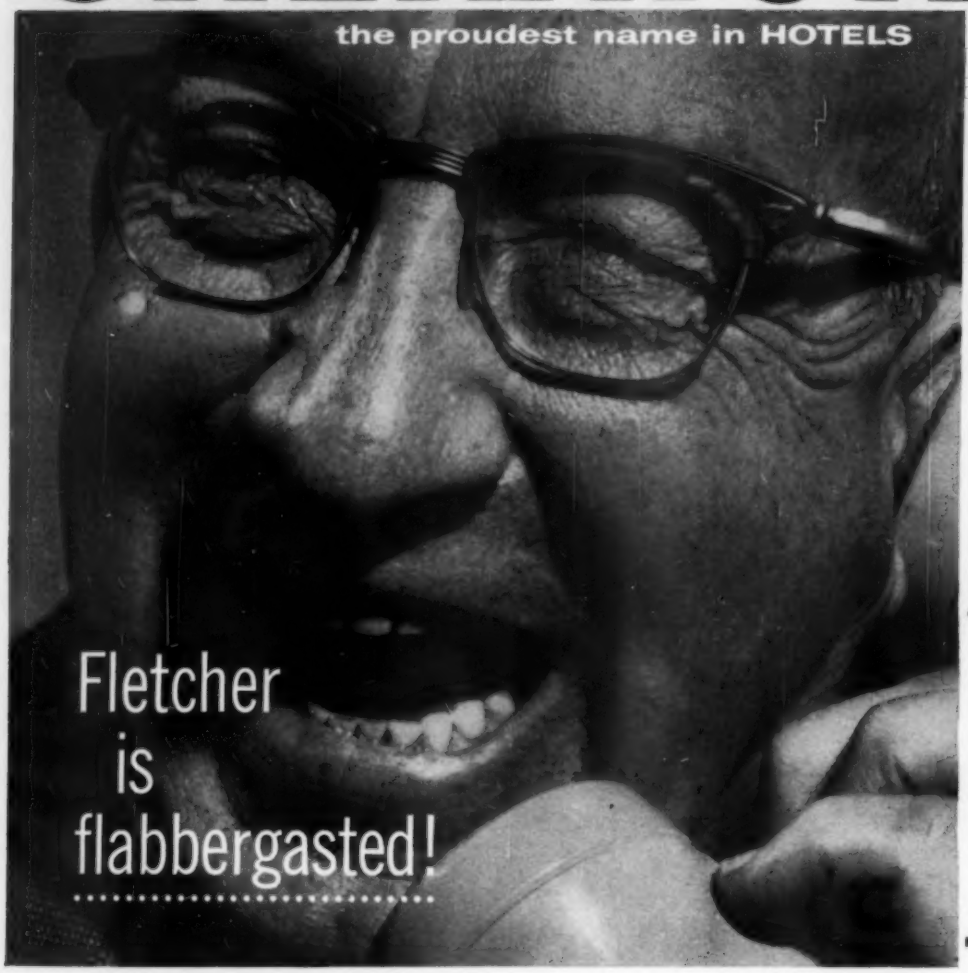

Which of these 39 cities is your next stop?

EAST
NEW YORK
BOSTON
WASHINGTON
PITTSBURGH
BALTIMORE
PHILADELPHIA
PROVIDENCE
ATLANTIC CITY
SPRINGFIELD, Mass.
ALBANY
ROCHESTER
BUFFALO
SYRACUSE
BINGHAMTON, N.Y.
(opens early 1959)

MIDWEST
CHICAGO
DETROIT
CLEVELAND
CINCINNATI
ST. LOUIS
OMAHA
AKRON
INDIANAPOLIS
FRENCH LICK, Ind.
RAPID CITY, S. D.
SIOUX CITY, Iowa
SIOUX FALLS, S. D.
CEDAR RAPIDS, Iowa

SOUTH
LOUISVILLE
DALLAS
(opens early 1959)
AUSTIN
MOBILE

WEST COAST
SAN FRANCISCO
LOS ANGELES
PASADENA
PORTLAND, Oregon
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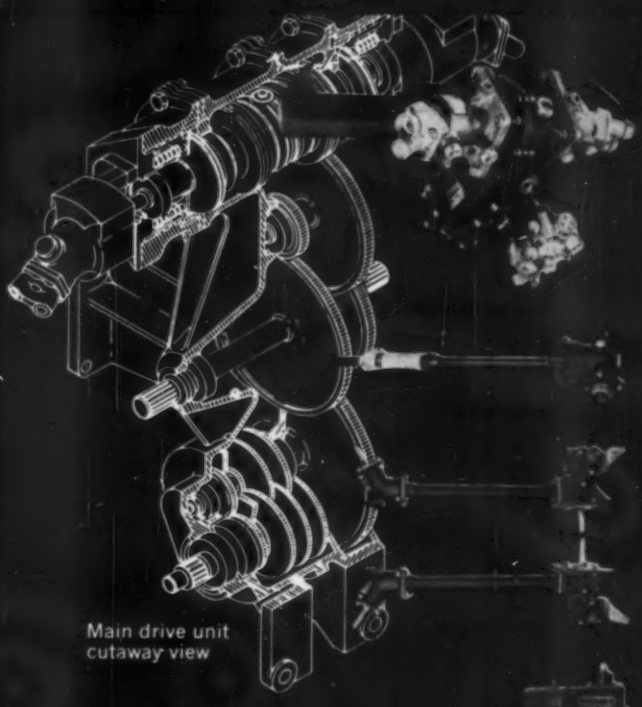
WESTERN GEAR *designs and builds wing flap control system for* CONVAIR 880



Main drive unit
cutaway view

The newly named Precision Products Division of Western Gear Corporation has launched an intensified program of developing systems for the aircraft industry. Stepped-up research, creative engineering, testing and manufacturing facilities put this division in the forefront of the nation's leading suppliers.

Most recent development is the wing flap control system for the Convair 880 jetliner. Western Gear carried the entire completely-integrated system through design, testing and fabrication, delivering the units shown here as well as torque tubes, driveshafts, motors and other components.

Complete reliability is the engineering and manufacturing *plus* that goes into every Western Gear component and system. Learn how this fast-moving company can help you with any needs in aero mechanics.

For full information, write today to:
WESTERN GEAR CORPORATION
Precision Products Division
P.O. Box 182 • Lynwood, Calif.

The new Navy method of basic jet training

North American Aviation's model T2J is an airplane conceived and created to meet every requirement of Navy basic training. The student stays with the same airplane from primary through basic, including instrument flying, armament handling and tactics, combat maneuvers, and an early introduction to carrier work. On completion of Navy basic training, he will be thoroughly conversant with all phases of jet operation up to high Mach numbers.

Performance with safety. The T2J's stall speed is only slightly above that of piston trainers. Top speed is 424 knots, and safe dive speed has been demonstrated at Mach 0.85. Endurance without external fuel is about 1½ hours. Two 100-gallon wingtip tanks give the T2J a range of over 800 nautical miles.

Simplicity of maintenance. The T2J has large, quick-opening access doors for waist-high engine maintenance; no stands or ladders needed. Ground handling and servicing can be done with standard field equipment. All equipment and systems are easily accessible.

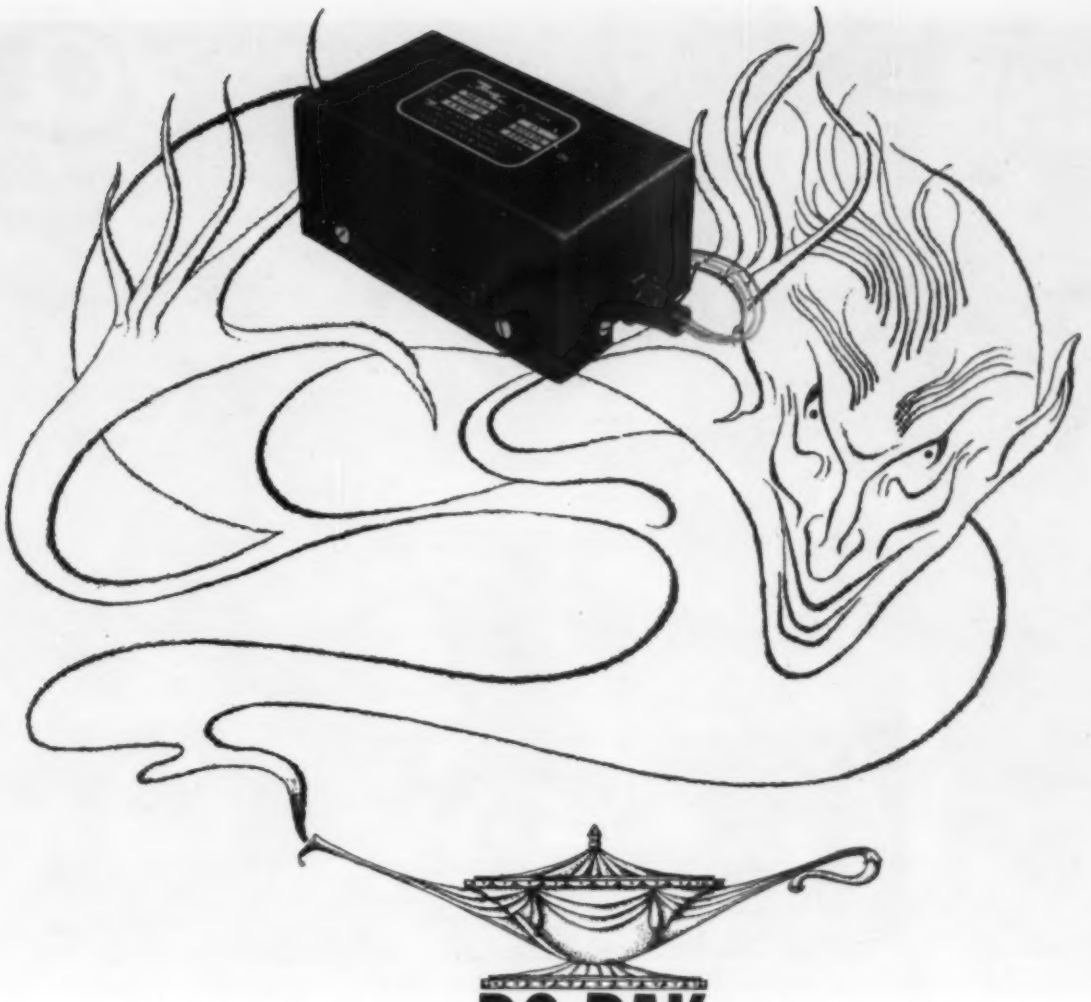
The T2J's powerplant, the Westinghouse J-34, has been removed in seven minutes, installed in twenty.

In production now. The T2J is now in full production at the Columbus Division of North American.

Double-threat weapon system. The A3J Vigilante, designed and built for the Navy by North American, is one of the world's fastest planes—yet unique aerodynamic and armament control features give it excellent low-altitude capability for attack bomber missions and landings on carrier decks and short runways ashore. An extremely accurate bombing-navigation system pinpoints the A3J's targets in any weather. And it can deliver every kind of weapon, including nuclear.

THE COLUMBUS DIVISION OF NORTH AMERICAN AVIATION, INC.

Columbus, Ohio



New Bendix DC-PAK is like magic

TREMENDOUS POWER OUTPUT IN A TINY STATIC PACKAGE

With its new line of DC-Paks*, Bendix now offers the latest in static power supplies for the aircraft and missile industries. Lightweight and compact, the DC-Pak provides reliable power packaged in the most practical manner for those industries where weight and space are at a premium.

The DC-Pak is built to give thousands of hours of efficient, trouble-free operation. Made with only four major parts (and no moving parts), it requires an absolute minimum of maintenance. For example, even a dead short across the output for a full hour will not harm the DC-Pak. Also input surge protection can be provided.

Units can be supplied with either single or multiple output, depending upon the needs of the customer. For full details on these transistorized units—and how they can be tailored to your exact voltage and amperage requirements—write BENDIX AVIATION CORPORATION, EATONTOWN, NEW JERSEY.

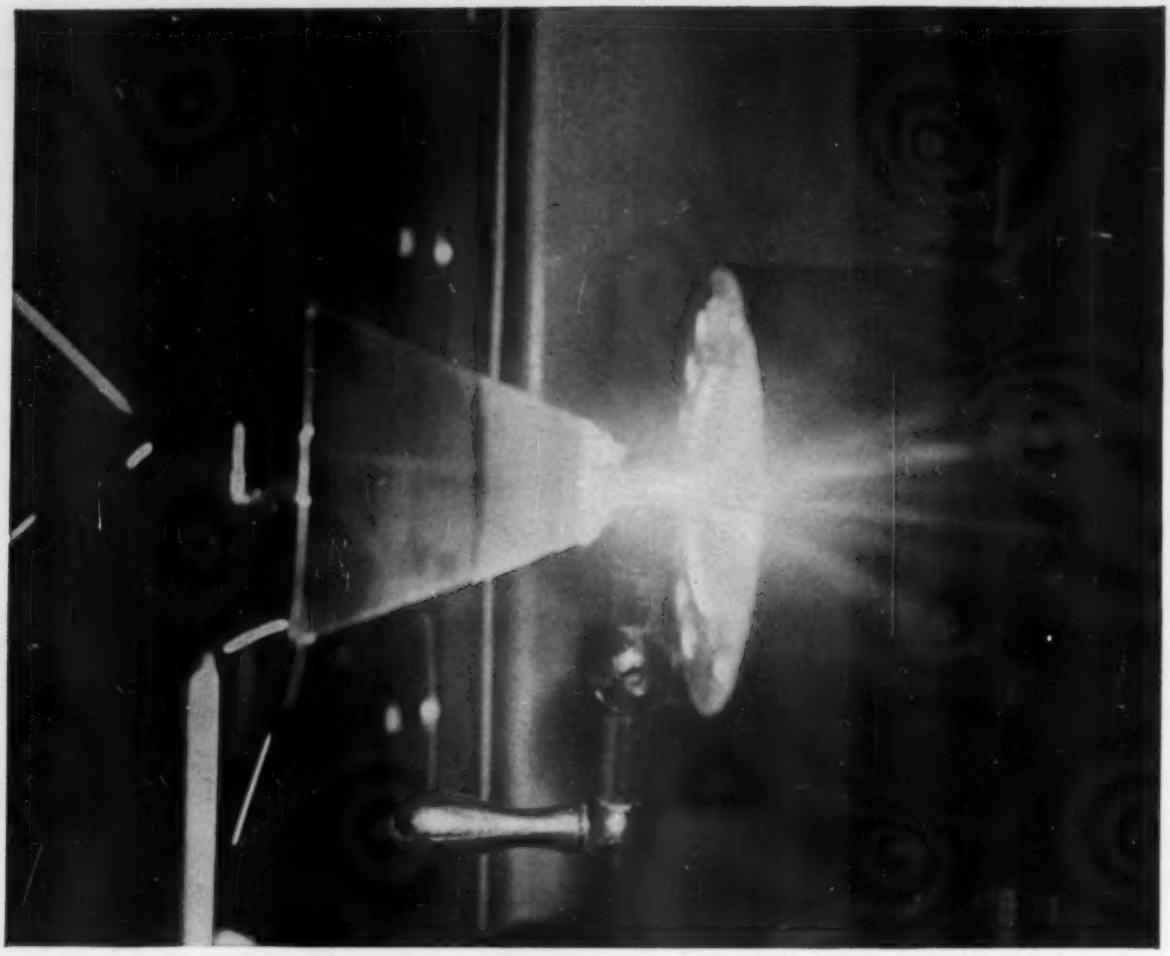
*TRADEMARK, BENDIX AVIATION CORPORATION

Specifications of Typical DC-Pak Units

Power Output	100 Watts	50 Watts
Output Voltage	500—5% VDC, 200 MA	250—5% VDC, 200 MA
Input Voltage	24—30 VDC, 27.5 Nominal	24—30 VDC, 27.5 Nominal
Voltage Regulation	5%; half to full load	6%; half to full load
Max. Operating Temp. (Ambient)	+60°C.	+71°C.
Max. Mounting Base Temperature	+71°C.	+80°C.
Min. Operating Temp. (Ambient)	−40°C.	−40°C.
Storage Temperature	−65°C. to +100°C.	−65°C. to +100°C.
Max. Surge Voltage	80 V. Peak	80 V. Peak
Ripple	1% RMS	1% RMS
Efficiency	80% at 25°C.	80% at 25°C.
Weight	1 lb. 8 oz.	1 lb. 8 oz.
Size	5 5/16 x 2 1/8 x 2 1/4	5 5/16 x 2 1/8 x 2 1/4
Electrical Connection	Four-Pin Connector	Four-Pin Connector
Accessibility	All parts are completely accessible and interchangeable.	All parts are completely accessible and interchangeable.

West Coast Office: 117 E. Providencia, Burbank, Calif.
Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.
Canadian Affiliate: Aviation Electric, Ltd., P. O. Box 6102, Montreal, Quebec.

Red Bank Division Bendix AVIATION CORPORATION



"...twice as hot as the surface of the sun"

New Plasmatron at Solar helps solve difficult super-heat problems

EXTREME HEAT presents a formidable barrier to the advancement of missile and nuclear technology. Solar is helping to push back this thermal barrier by controlling temperatures higher than those of the surface of the sun... for advanced research in high-temperature problems.

Solar's new Plasmatron, above, is a device which generates heat to 30,000 F at ordinary atmospheric pressure. It is opening new fields of research in aerodynamics, radiation, metallurgy, chemistry and in the testing and application of high-temperature materials and coatings. In addition, the Plasmatron is used in wind tunnel studies and in other fields of research.

For more than three decades Solar has been a leader in high-temperature technology. Today Solar is applying its background of knowledge and experience in creating missile nose cones, rocket chambers, nuclear components and other products for high-temperature, high-stress requirements. This know-how and experience—plus a continuing program of creative research—is available for your important missile or nuclear program. For details write to Dept. F-122, Solar Aircraft Company, San Diego 12, California.

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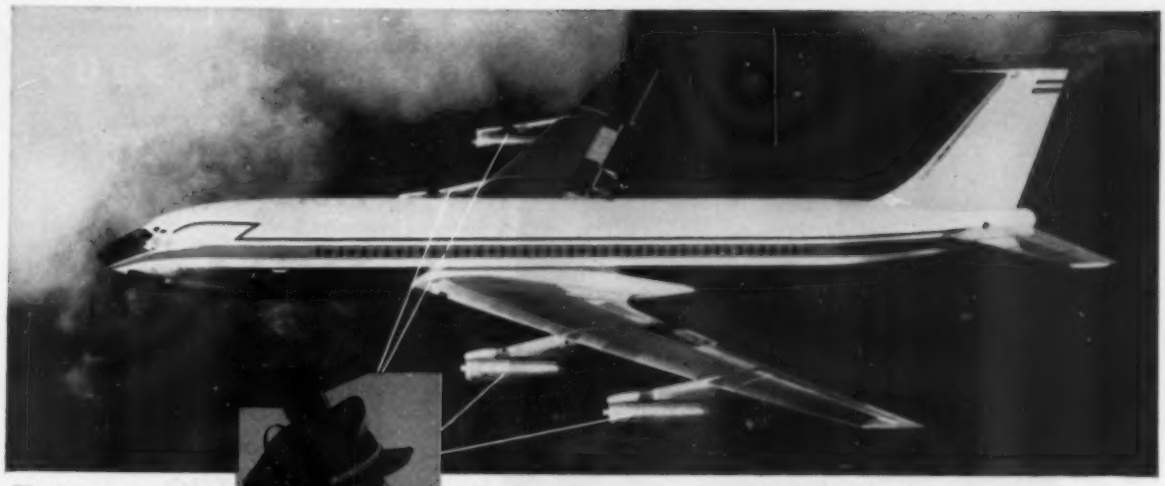
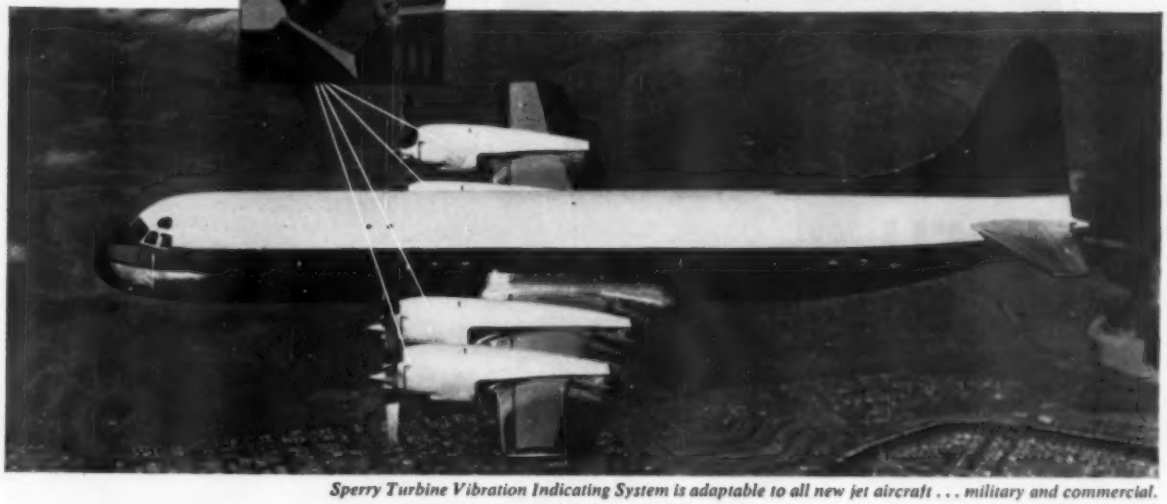


Turbine to pilot: "Operation normal... no vibration."



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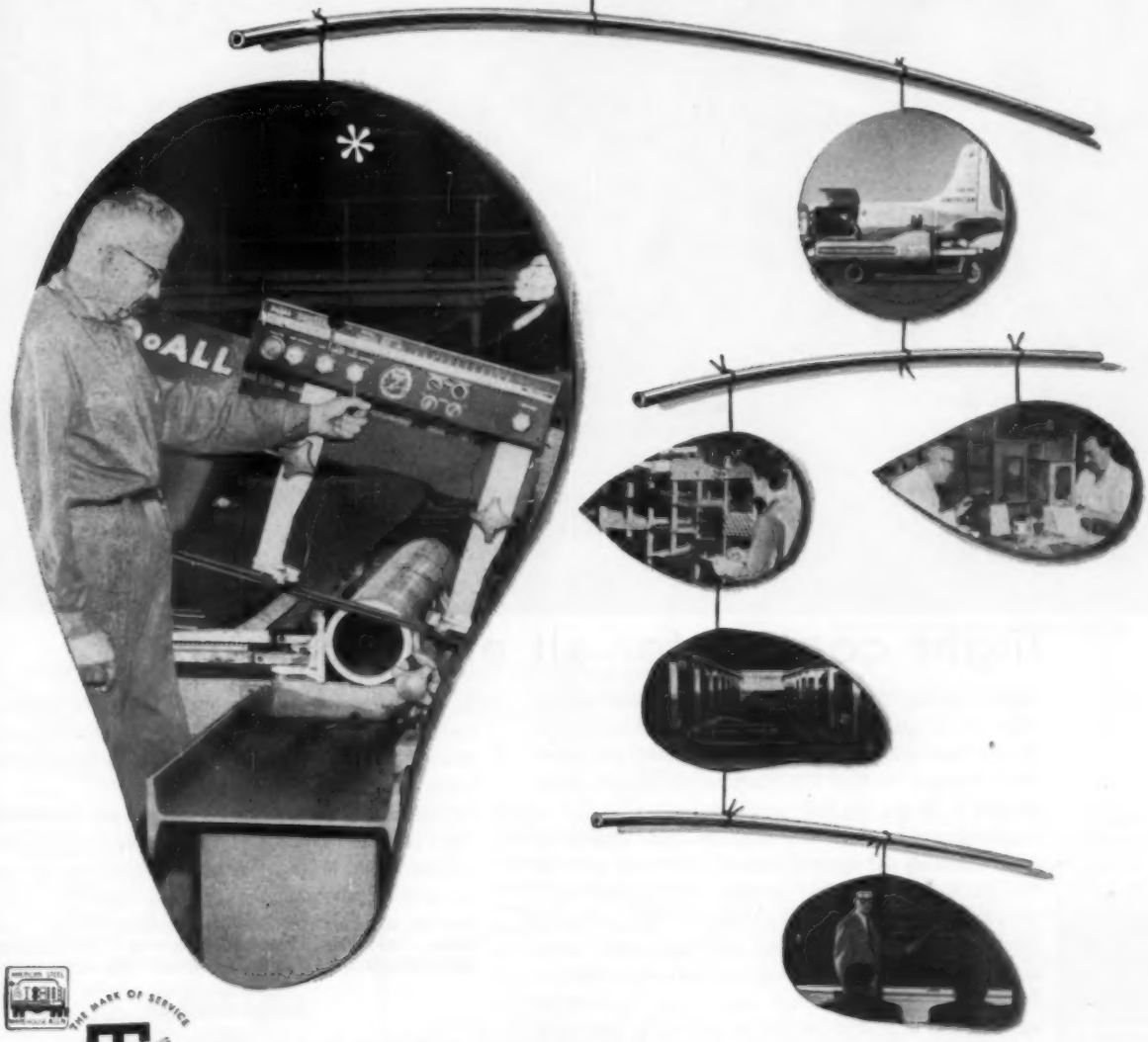

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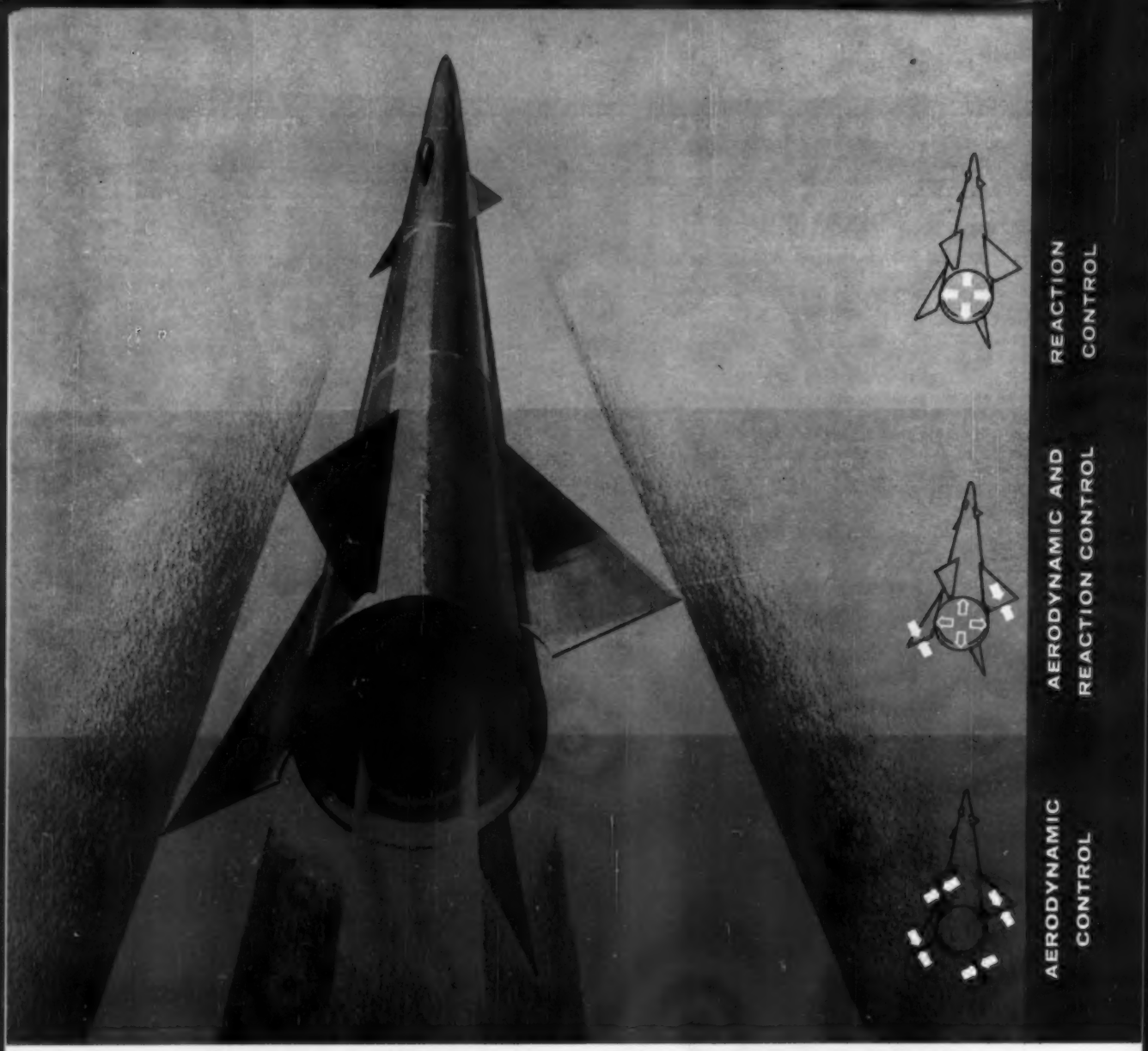

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COVER: Vickers Vanguard turboprop transport has completed 11 test flights totaling 16 hr. at Vickers-Armstrongs (Aircraft) Ltd. test facility in England. Aircraft is the first of five which will be used in the certification program by September, 1959. Test program calls for about 1,500 hr. of flight tests before Vanguard is delivered to British European Airways in the spring of 1960. About twice the size of the Vickers Viscount, Vanguard has gross weight of 141,000 lb.; powerplants are four Rolls-Royce Tynes, producing 4,500 eshp. each (AW Dec. 29, p. 32).

PICTURE CREDITS

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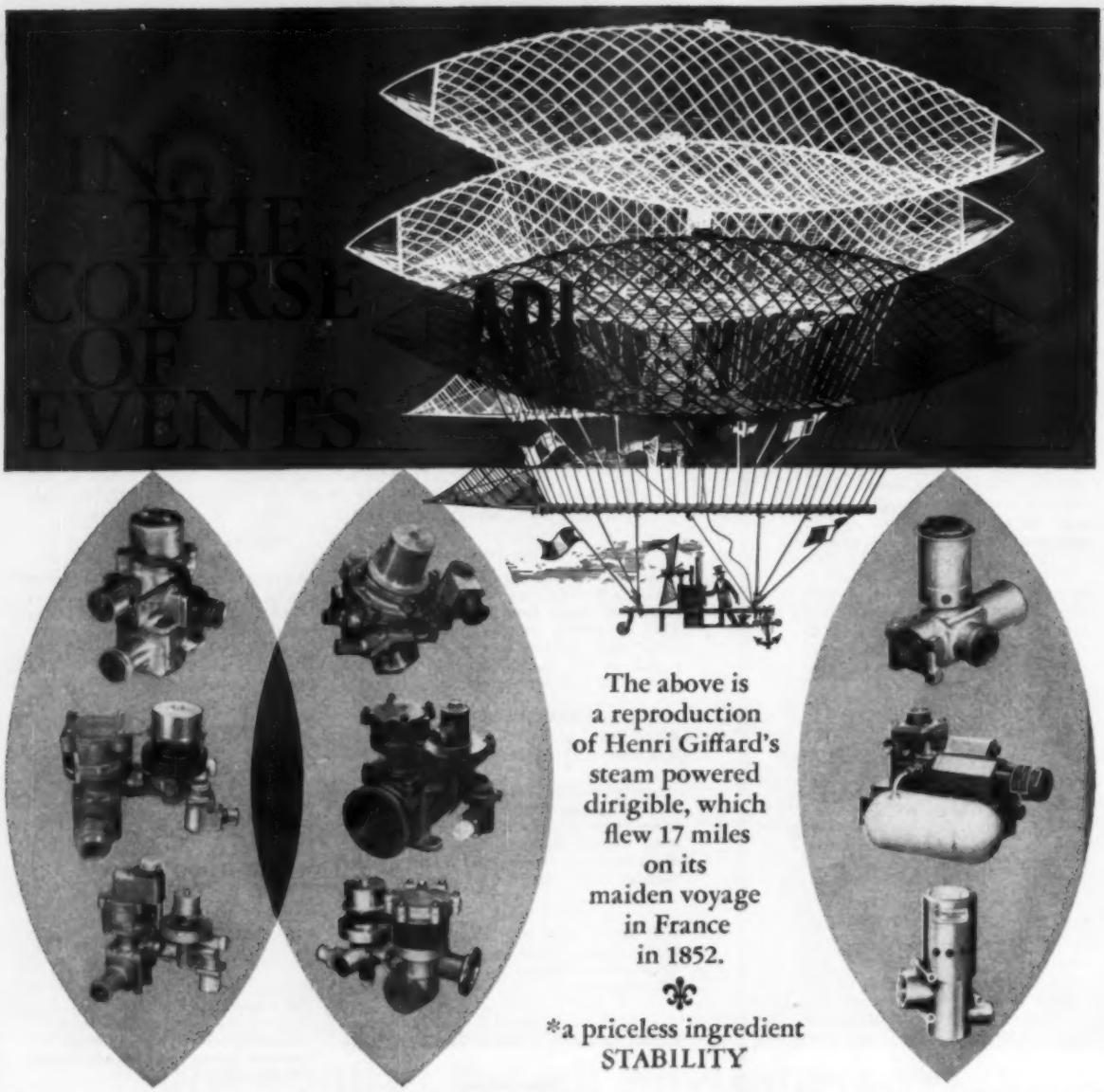

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EDITORIAL

Rewards and Responsibility

The airline pilots have been remarkably successful in their battle to gain for themselves what they consider their proper reward for their work in the new jet transport era. Top pay for jet airliner captains in international service is $33,600 while, for similar duties in domestic service, a maximum of $28,000 is attainable. According to C. L. Sayen, president of the Air Line Pilots Assn., the average annual wage of all airline pilots even before the jet pay boosts was $12,000. A total of 600 airline pilots earned $20,000 or more before the jet pacts. The pilots also have been reasonably successful in establishing their professional position in the jet cockpit to their satisfaction.

With these rewards under their belt, we respectfully suggest that the pilots give some serious thought and earnest effort to fully discharging their responsibilities to their managements and the traveling public that has so eagerly taken to the jet age. We are extremely sympathetic to the pilot's point of view and his multitudinous problems. We came into aviation via the cockpit and spent sufficient time in both military and civil operations to understand how all of the other elements of aviation—engineers, weather forecasters, federal bureaus, flight surgeons, dispatchers, etc.—apparently combine in a vast and continuous conspiracy to unnecessarily complicate operations in the cockpit.

We also have fought hard editorially for many of the safety devices and procedures, such as radar, high intensity approach lights, modernized airways systems and navigation aids, that the pilots have felt necessary to their improved operations.

But there have been indications recently that some airline pilots are willing to accept the rewards of their work without fully discharging all of their responsibilities. Let us cite a few of these storm warnings that already have appeared on the air safety horizon.

Most recent is the case of the Pan American Boeing 707 jet transport that peeled off into a spiral full-power dive from 35,000 ft. with 114 passengers aboard and exceeded its Mach limit and pulled more than 3g's in making a miraculous recovery at only 6,000 ft. above the Atlantic. The full report on this incident has not yet been made. But it is already evident that a too casual approach by the pilots to the task of operating this aircraft were contributing causes. It is already apparent that all of the safety warnings installed to prevent an incident of this sort operated properly but went unheeded by the pilots until small errors were compounded into a near miss. Pan American's ruling that two pilots must remain in their seats with belts fastened and oxygen masks on is a recognition of the problems involved in fully discharging a jet transport pilot's responsibilities.

The recent spot check by the Civil Aeronautics Administration on the instrument capabilities of Northeast Airlines' pilots (AW Oct. 27, p. 38) is another case in point. The results of this check were truly shocking. One pilot had only the foggiest notion of how to execute airways traffic control procedures. Another experienced extreme difficulty in operating a DC-6B on instruments and at least nine were found to be too deficient in instrument capability to continue line operations without further training.

We also recommend a thorough reading of the Civil Aeronautics Board report on the Braniff DC-7C crash near the Miami airport (AW Feb. 9, p. 103) for another indication of how a too casual attitude toward small early warnings of impending trouble and a questionable proficiency in the cockpit can be compounded into tragedy.

Another point we believe pertinent to this discussion is the growing tendency of airline pilots to use their large blocks of leisure time to operate other commercial enterprises. Now 80 hr. a month is certainly not long to spend at an occupation that yields up to $40,000 annually. But to operate these 80 monthly hours in the air safely and efficiently requires the full time professional attention of the men involved. Their job should begin long before they report in to flight operations to plan a particular flight. This problem of maintaining full professional proficiency is even more acute with the advent of the jet age.

A man who accepts the lucrative rewards of operating high speed, high altitude, high-density-seating jet transports owes his passengers and his management his full professional attention far beyond the 80 monthly hours in the air and the minimum preflight planning time.

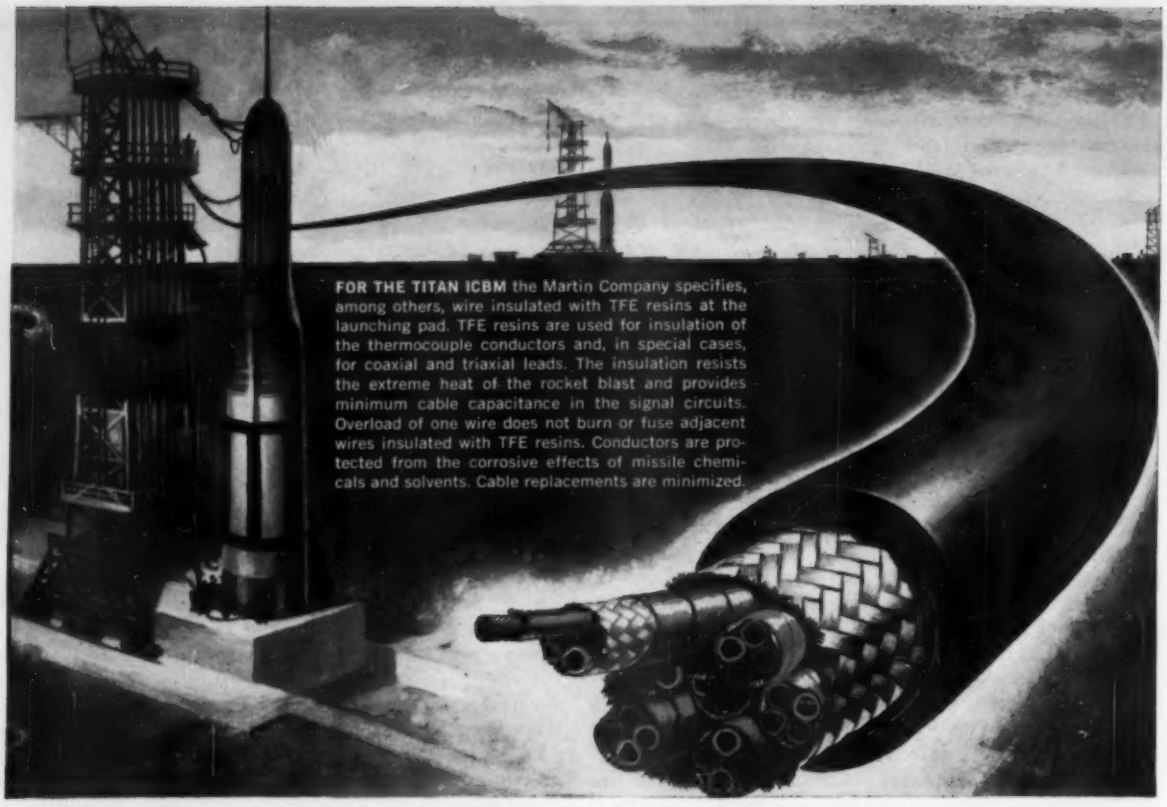
We seriously question whether this degree of professional concentration and efficiency can be maintained by men who are operating insurance agencies, real estate deals, wheelbarrow factories or any of the other varied commercial enterprises that have become a standard feature of so many airline pilots' ground time.

The question of pilot age and physical standards is bound to become more acute with the jet age. There must be some more satisfactory method of combining the rich experience that only accrues to the 20-year veterans with the mental alertness and quick reflexes required for safe and efficient jet operations than the rigid seniority system now imposed by the Air Line Pilots Assn. We hope that the new Federal Aviation Agency will fully explore this problem as a high priority project.

Although the airline pilots have taken a union labor approach to solving their working problems, they are still an integral part of the airlines' management structure and a vital part in the management's success or failure. We think that some airline managements and some segments of the Pilots Assn. are missing an opportunity by not fully exploiting this relationship. The pilot is perhaps the most important point of contact between the airline and its fare paying customers. We have all seen many examples of how a pilot who recognizes this generates satisfied travelers for his airline and how "cowboys" who operate as though their rear cabins were filled with cattle instead of human beings drive ticket purchasers to fly under some other flag. And, of course, the most substantial contribution the pilots can make to passenger revenue is a perfect safety record.

The advent of the jet age has imposed new standards of efficiency and responsibilities on the airline pilots. Airline management has set their rewards at levels commensurate with the tasks imposed. If the pilots fail to fully discharge their responsibilities under these new standards, airplanes will be bent and people hurt, including the pilots.

—Robert Hotz



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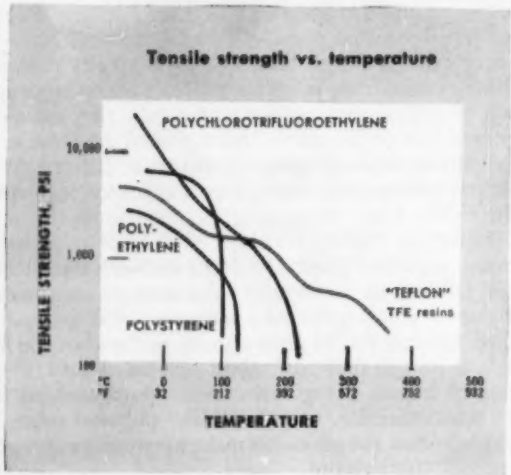

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WHO'S WHERE

In the Front Office

Republic Aviation Corp., Farmingdale, N. Y., has elected the following officers: **Thomas Davis**, financial vice president; **James L. Murray**, vice president-sales; **George H. Connerat**, treasurer.

Frank B. Jewett, Jr., executive vice president, Vitro Corporation of America, New York, N. Y., and **William B. Hall**, a vice president.

Paul F. Smith, president, Parker Seal Co., Culver City, Calif., a division of Parker-Hannifin Corp., Cleveland, Ohio. Also: **Scott A. Rogers**, vice president; **T. J. McCuistion**, vice president-sales.

Mid Continent Airmotive Corp., Kansas City, Kan., new subsidiary of Pacific Airmotive Corp., Burbank, Calif., has appointed the following: **Horace A. Smith**, president; **Roy Backman**, vice president; **R. C. Emrey**, secretary-treasurer. Also: **James M. Staker**, Denver, Colo., branch manager, and **Boyd H. Gillen**, Chicago, Ill., branch manager.

Luis Paul, first vice president, LAV, The Venezuelan Airline.

C. E. Liske, vice president-traffic and sales, Chicago Helicopter Airways, Inc.

Dr. O. G. Haywood, corporate group vice president-military products and industrial instruments, F. C. Huyck & Sons, Huntington Station, N. Y.

Howard F. Beir, vice president, Aircraft Exchange, Inc., New York, N. Y.

William W. Scull, vice president-manufacturing, The B. F. Goodrich Co., Akron, Ohio.

J. K. Dysart, vice president-sales and marketing, Leach Corp., Compton, Calif.

Bernard J. O'Neill, vice president-engineering, Magnetic Amplifiers, Inc., New York, N. Y.

The Federal Aviation Agency, Washington, D. C., has announced the following appointments: **George R. Borsari**, Chief, Airport Division, Bureau of Facilities, and **Capt. Alden C. Packard** (USN), Deputy Director, Bureau of Research and Development.

Brig. Gen. Ernest F. Easterbrook has assumed command of the Army Aviation Center and Fort Rucker, Ala., replacing the late Maj. Gen. Bogardus S. Cairns.

Honors and Elections

Dr. William H. Pickering and **Dr. James A. Van Allen** have received the Army's Distinguished Civilian Service Award. Dr. Pickering, Director of Jet Propulsion Laboratories, was cited "for exceptional technological and leadership contributions to the Army's mission in the intermediate range missile and space fields. . ." Dr. Van Allen, Chairman of the University of Iowa's Department of Physics, was cited "for exceptional contributions in the conception, planning and execution of the scientific research phase of the U. S. International Geophysical Year Program. . ."

Dr. Don L. Armstrong, manager of Aerojet-General Corp.'s Chemical Division, has been elected chairman of the Southern California section of the American Chemical Society.

(*Continued on page 122*)

INDUSTRY OBSERVER

►Air Force and Army anti-ballistic missile projects are considering the feasibility of placing a cloud of sand across the path of an incoming warhead. Sand would destroy warhead by rapid erosion, friction and penetration. Army's Western Electric-Douglas Nike Zeus would detonate a nuclear warhead to neutralize enemy warhead by neutron pollution.

►General Electric has developed a new technique that will enable its ground-based ballistic missile radar-command guidance system to simultaneously guide a number of missiles. Inability of GE system to guide more than one missile at a time was one of major factors behind Air Force decision last summer to substitute American Bosch Arma inertial guidance on later models of the Atlas. New technique may cause Air Force to re-examine its ballistic missile guidance plans.

►Fundamentally different technique for determining direction of earth's vertical from a vehicle operating within the earth's atmosphere, which does not use gravity-sensing element in the vehicle, is being investigated by Collins Radio Co. Technique, if proven successful, would eliminate effect of vehicle acceleration which introduces errors in present gyros that use gravity sensing devices. Program is being sponsored by Wright Air Development Center's Flight Control Laboratory.

►Project Saturn is the designation of a new Army orbital space program now under development by the Army Ballistics Missile Agency. Powerplant manufacturer is North American Aviation Inc.

►Major reduction in cost of producing transistors is expected to result from a new semiconductor fabrication technique developed by Westinghouse Electric under Wright Air Development Center sponsorship. Official announcement is expected this spring.

►Pratt & Whitney J58 turbojet developed for Navy may be used in follow-on version of the Northrop Snark surface-to-surface cruise missile. About 20 of the high-thrust turbojets probably already have been built under the Navy program.

►Convair-designed fuel utilization system for precision metering of propellant for Atlas ICBM has substantially exceeded performance expectations in a number of successive test firings of the missile from Cape Canaveral, Fla.

►Bendix Pacific Division is building a new sonar system projected for installation and testing on Sikorsky's amphibious HSS-2 helicopter, which would lower sonar equipment into water from hover or from the surface in calm seas. Sonar gear is expected to cover three to four times the area possible with present equipment.

►Fuel cell which may be able to convert gasoline and air directly into electricity with extremely high over-all conversion efficiency of between 55 and 65% is being developed by General Electric under Army sponsorship. The device—basically, a hydrogen-oxygen fuel cell employing a catalyst to convert gasoline into hydrogen—may prove valuable on a space-vehicle powerplant.

►Air Force is considering use of Army Ordnance facilities for some production and assembly of the Minuteman solid-propellant ICBM in a move to expedite work and cut costs. Ordnance sites in the midwest would get the emphasis under the plan.

►Swivelling of Jupiter engine controls pitch and yaw, but roll is controlled by simply moving turbine gas vent by means of an actuator. Flexible metal vent pipe, which can be bent like a wiring cable, is replacing stovepipe-like vent that appeared on research and development models.

►Lear Inc. is building a three-axis stability augmentation system for Northrop's T-38 Talon. First flight of Talon may be made before the end of the month.

HOW THE SILICONES MAN HELPED... BREATHE MORE LIFE INTO AN OXYGEN MASK

Aboard the new jetliners, oxygen masks are standard emergency equipment. If air pressure in the cabin drops, passengers and crew members can quickly breathe oxygen from a piped system.

Based on experiments by the military, manufacturers know that silicone rubber is the ideal material for oxygen face masks. It provides the thin, elastic shapes needed to fit all facial contours . . . with a gentle lubricity that feels pleasant to the skin. Since silicone rubber is highly resistant to oxidation, ozone attack and extremes of temperature, it can be stored for long periods and take repeated hot-water cleansing. *And*, any color is available—even "emergency" yellow.

This jet-age application demonstrates several useful properties of UNION CARBIDE silicone rubber. Background information and technical data available by writing Dept. BA-9901, Silicones Division, Union Carbide Corporation, 30 East 42nd St., New York 17, N.Y. *In Canada:* Bakelite Company, Division of Union Carbide Canada Limited, Toronto 7.

Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils and Emulsions

UNION CARBIDE SILICONES

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Washington Roundup

Regrouping Air Defense

Watch for all air defense research and development to be shifted out of Air Force, Army and Navy and concentrated directly under the supervision of Dr. Herbert York, Defense Department director of research and engineering. Incompatibility of air defense weapon systems already developed and produced by the separate services with a single over-all defense system, is the reason for the shift. MITRE, the non-profit technical advisory group spun off from Massachusetts Institute of Technology for technical monitoring of USAF Cambridge air defense systems integration group, probably will continue to serve as Dr. York's technical supervisor in this area.

'Hardened' Bomarc Sites

Boeing Bomarc interceptor missile will shift from present sheet metal missile shelters to a "hardened" concrete shelter for the longer ranged Bomarc B model to provide greater resistance to enemy atomic attacks on the air defense system. New Bomarc shelter has precast concrete slabs as halves of flat roof with equipment to slide slabs back onto a steel frame leaving the missile exposed for firing.

Hawk: European Production

Public announcement of a project for European production of the Army-Raytheon Hawk low-altitude air defense missile is expected shortly. It is understood the project will total about $500 million. Countries participating include France, Italy, Germany, Belgium and the Netherlands. Discussions also are under way for possible European production of Navy's Sidewinder air-to-air missile. European production of a solid-propellant intermediate range ballistic missile, possibly the Martin Pershing, also is being considered. Under Defense Department's "facilities assistance" program, the U.S. furnishes know-how and such items as machine tools, jigs, dies, mechanical engineering drawings for the overseas production programs.

Military Construction

Lion's share of this year's $1.3 billion military construction program is for the Air Force. The program submitted to Congress last week for authorization is divided this way: USAF, $892 million; Army, $260 million; Navy, $203 million. The largest individual projects are: Lemoore, Calif., Naval Air Station, $26.9 million; Pt. Mugu Pacific Missile Range, $30 million; Andrews AFB, Md., $21.8 million; Wright-Patterson AFB, $12.5 million; Richard I. Bong, AFB, Wis., $21.5 million.

CAB Refusal

Civil Aeronautics Board has refused to make additional comments on its Sept. 23 statement with respect to a jet surcharge on North Atlantic routes despite urgent requests from three U.S. carriers that a clarification of the statement is essential to a solution of the controversial surcharge issue. International Air Transport Assn. traffic conference has convened in Paris this week in hopes of ironing out the problem. All three carriers protested that the Board's statement has been misinterpreted by foreign carriers and, according to Seaboard and Western Airlines, a further clarification is needed to provide an "opportunity for a much-needed compromise solution to the current IATA impasse."

Pan American World Airways, a strong opponent of the surcharge, supported the Board's refusal to enlarge upon its position and called the original statement "not only clear but sound." Pan American also noted that the CAB letter repeated previous statements by the Board "to United States carrier members of IATA to the effect that . . . it frowns upon equipment (fare) differentials."

Railway Labor Act

In another area, informed observers believe the Railway Labor Act will remain virtually unchanged despite a joint meeting called by the Department of Labor last week between airline managements and labor leaders. Reports from the closed-door session indicate that the Air Line Pilots Assn., Flight Engineers International Assn., and International Assn. of Machinists remained solid in their opposition to industry-suggested changes in the act which call for a ban on jurisdictional walkouts, a secret ballot on strike votes, time limit on mediation efforts and prohibition of secondary boycotts. It also was indicated that American, Trans World, Continental and Trans-Texas airlines joined with union leaders in opposing recommendations by Eastern and United airlines urging a form of compulsory arbitration. Department of Labor spokesmen declined to confirm or deny the reports and observed that the meeting was closed to the press on the basis of "past experience" which showed that publicity of heated discussions at such meetings too often resulted in nothing being accomplished.

Higher Taxes

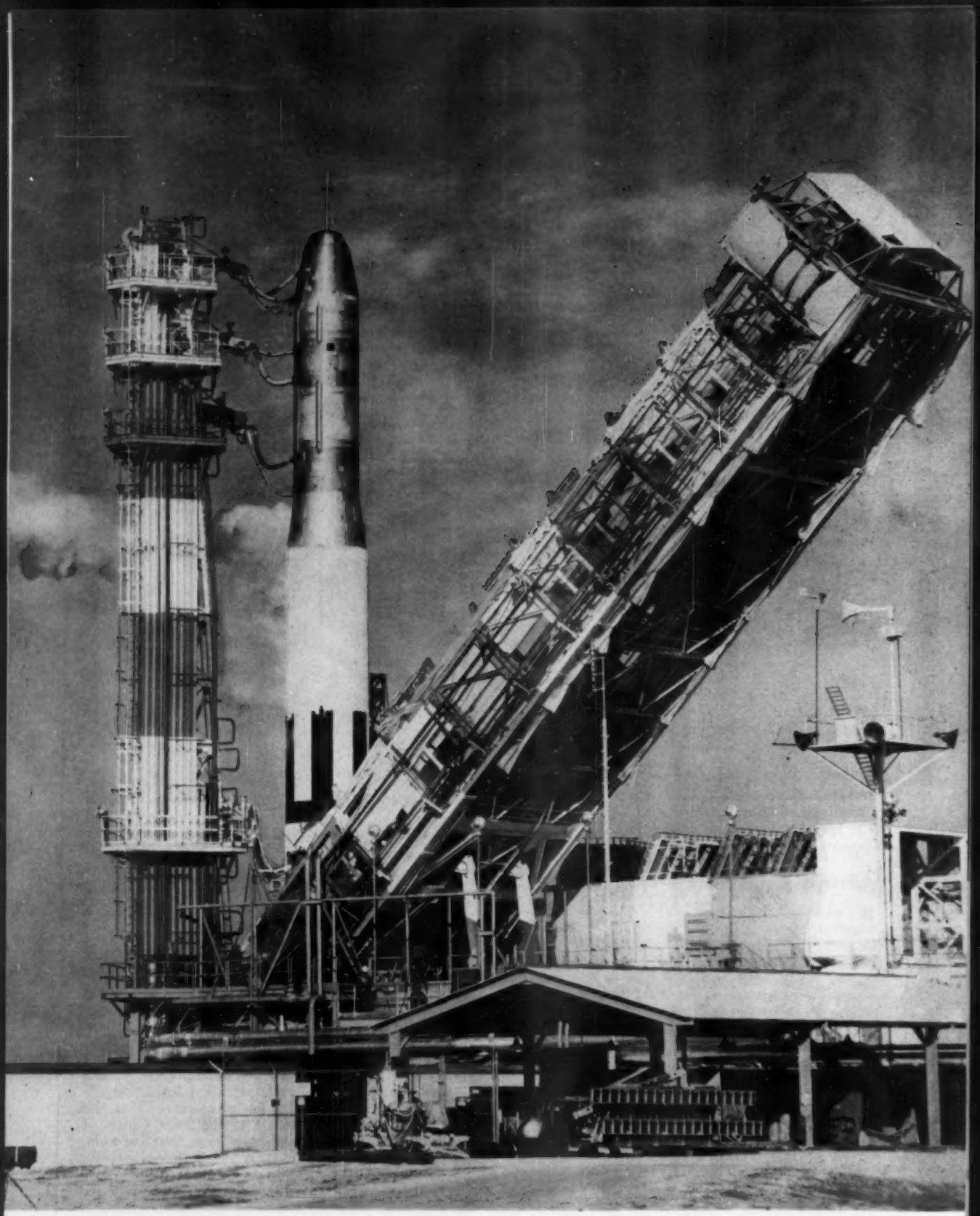
Meanwhile, Rep. John McCormack (D.-Mass.), House majority leader, has urged President Eisenhower to call for higher taxes—if this is necessary to finance greater defense spending within a balanced budget. McCormack complained that talk of tax cuts and reduced spending by Administration officials has led to a "feeling of complacency" by the American public and a dangerous belief that there is "nothing to fear from the Soviets."

Defense Information

Rep. Carl Vinson (D.-Ga.), chairman of the House Armed Services Committee, has told Secretary of Defense Neil McElroy that it would be illegal to place the information activities of the eight unified and specified commands directly under Assistant Secretary of Defense for Public Affairs Murray Snyder as proposed. Vinson pointed out that defense reorganization legislation enacted last year establishes the line of command from the Office of Secretary of Defense to the Joint Chiefs of Staff to the commands, making it clear that the commands are not to be administered directly from the office of the Secretary.

During congressional testimony, McElroy had reported on a plan to place the command information activities under Snyder.

—Washington staff



MARTIN TITAN intercontinental ballistic missile is raised into position on its Cape Canaveral, Fla., launch pad by this erector tower, shown being lowered into horizontal position before actual firing. Power and instrumentation lines are connected to the missile from the umbilical tower at left. Titan now is on assembly line production at The Martin Co., Denver, Colo. ICBM plant.

Space Technology

Plans Detailed for Titan Complex Design

By J. S. Butz, Jr.

Washington—Competitive bids will be opened Mar. 19 for the construction of the nation's first operational underground missile base at Lowry AFB, Colo., to house the Martin-Air Force Titan intercontinental ballistic missile.

Construction of this "hardened" reinforced concrete and steel complex to house one squadron of Titans, with nine separate underground emplacements or "silos" is scheduled to be completed 730 days after the award of a contract which probably will be made around April 1. Total of $45 million already has been released by Air Force to get construction under way.

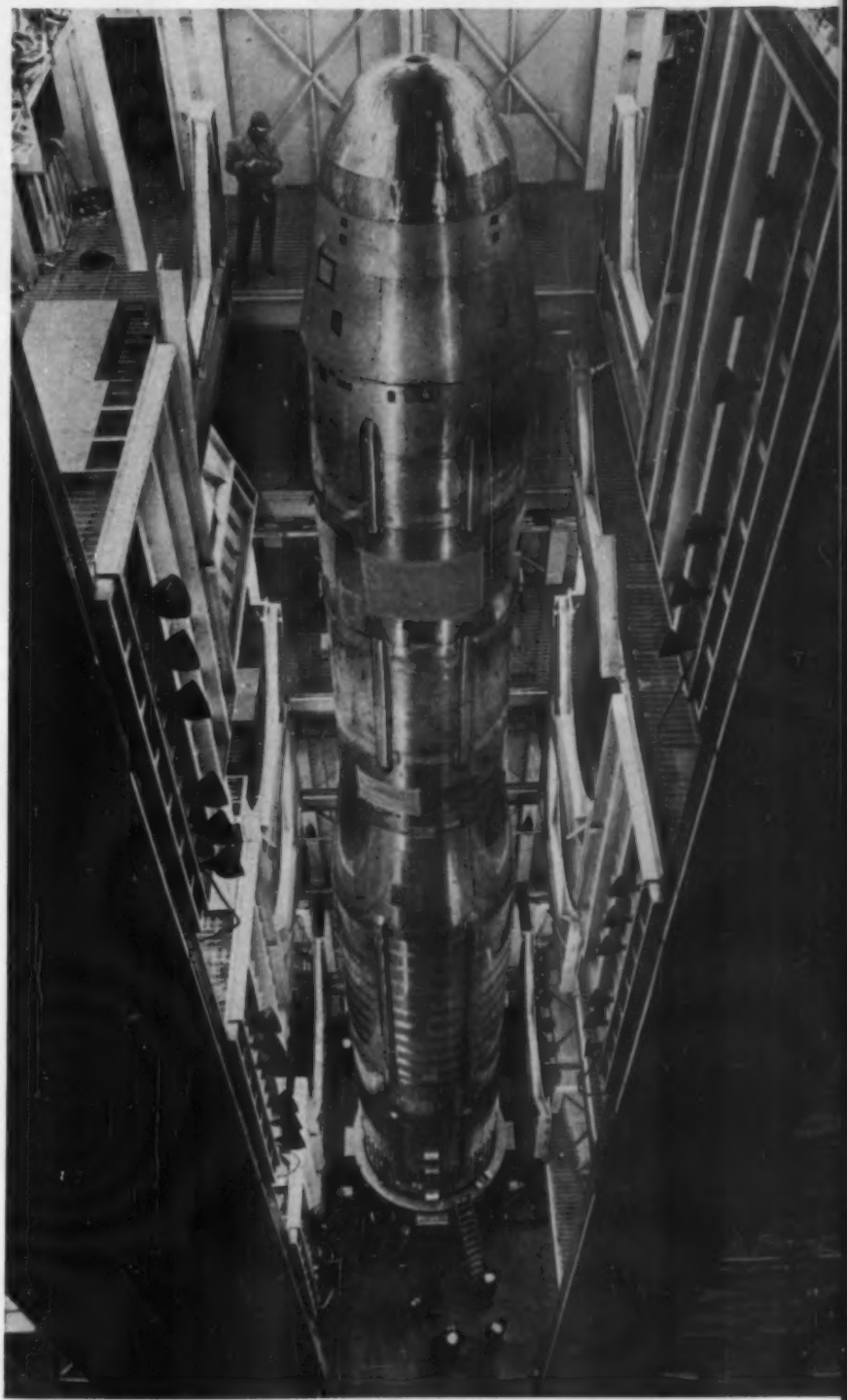
Requests for bids to handle the construction were made by the U. S. Army Corps of Engineers shortly before the first successful firing of a Titan test vehicle from Cape Canaveral, Fla., on Feb. 6. The development vehicle flew between 250 and 300 mi. in limited-range tests.

Corps of Engineers also have asked for bids to construct additions to the training base facility at Vandenberg AFB, Calif. This work includes three underground missile silos similar to the ones to be built at Lowry AFB. Primarily intended for training purposes, these installations also will have operational capability if garrisoned by trained troops.

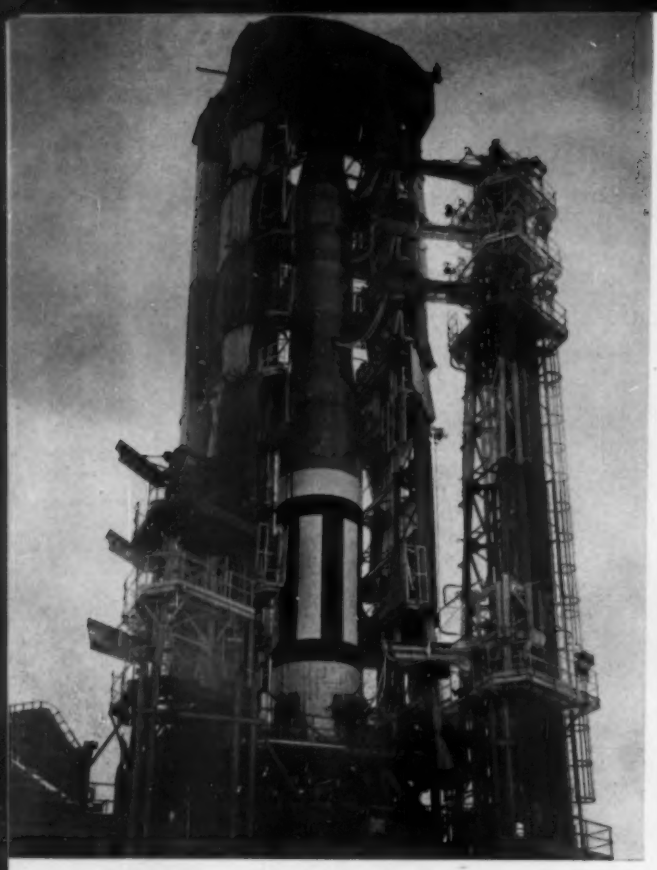
The first operational base at Lowry AFB consists primarily of the following concrete and steel chambers.

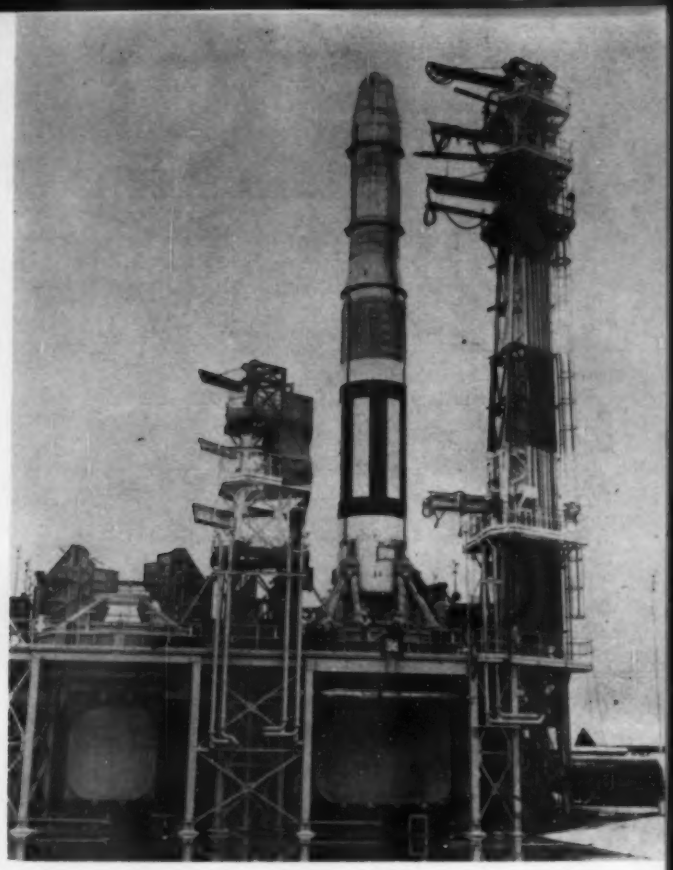
- **Nine operational silos** 163 ft. deep and 40 ft. in diameter, with elevators to lift the missile to ground level for firing after preparations have been accomplished underground.
- **Three portal (storage)** silos 73 ft. deep and 27 ft. in diameter.
- **Three control centers of spherical** shape with a 51 ft. radius and an inside height of 35 ft., 9 in. at the center.
- **Three powerhouses of spherical** shape with a 62 ft. radius and an inside height of 46 ft. at the center.
- **Nine equipment silos** 62 ft. deep and 40 ft. in diameter.
- **Nine propellant terminals** 47 ft. deep and 37.5 ft. in diameter.
- **Six antenna terminals** 68 ft. deep and 27 ft. in diameter.

Two attempts to launch a Titan test vehicle consisting of a live first stage, a second stage loaded with water and a dummy warhead preceded the recent successful firing. In each case, the missile had been restrained on its pad and the first stage engine automatically shutdown when trouble developed during

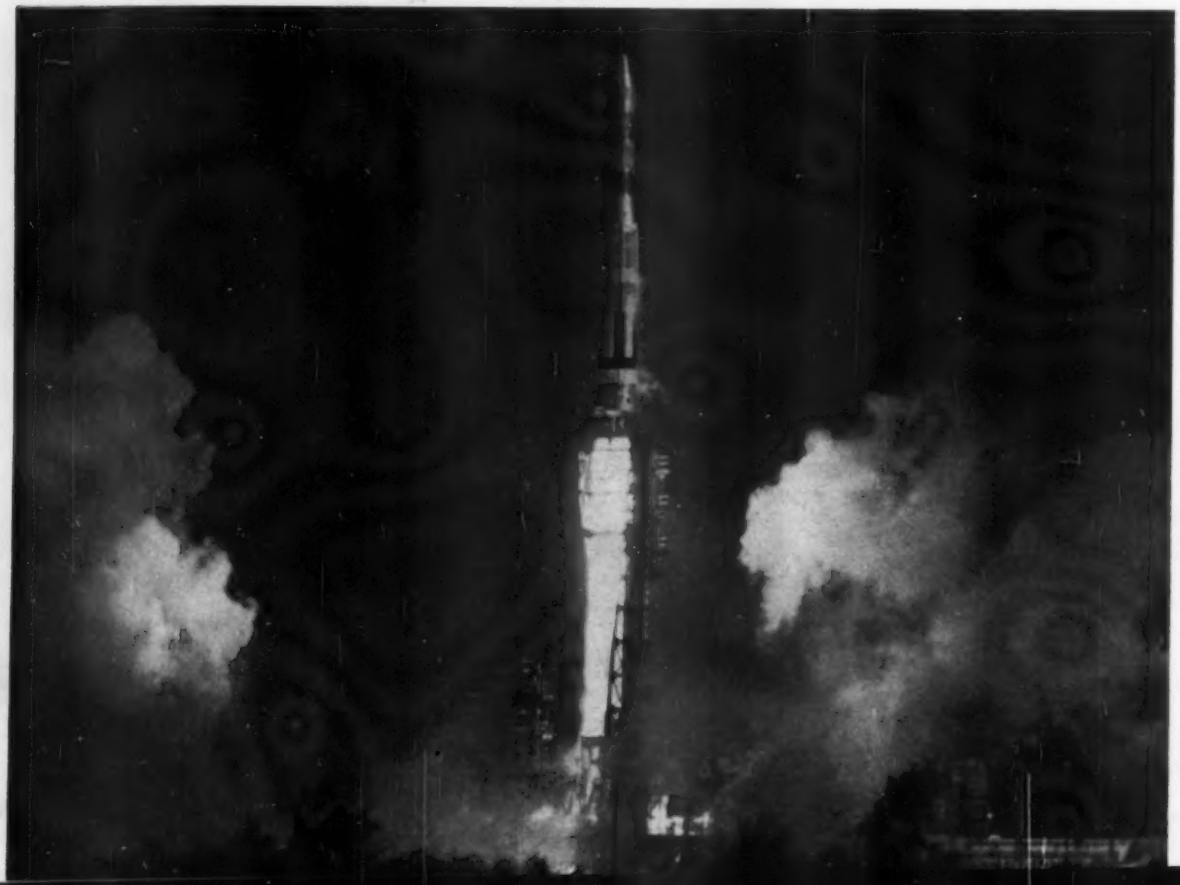


TITAN ICBM is checked by technicians at Matrin's vertical test laboratory at Denver, prior to shipment to Cape Canaveral. Titan is powered by an Aerojet-General liquid fueled rocket engine and has both radio-inertial and all-inertial guidance systems.





ERECTOR TOWER is in full vertical position at left. Launch stand utilizes two steps, so that first and second stages can be static-tested separately (note two flame deflectors at right). Practice firing and checkout is done sequentially; electronic control of the count-down and simulated flight is rigged so that second stage fires at same point in sequence that it would in actual flight.



a 6.1 sec. test firing period just prior to launch.

During this period, the first stage engine builds to maximum thrust within about two seconds if operating properly; the remaining four seconds are used to check behavior of auxiliary systems.

Operational countdown and launching of a Titan will take place in the relative safety of a "hardened" underground installation capable of withstanding near misses by thermonuclear weapons, but it will not be materially shorter than the launching time required by other liquid-fuel ICBMs. The time will be much longer than the 15 min. now widely quoted as the warning time which will be available in the event of a sneak ICBM attack.

Checkout and maintenance of most of the Titan's systems can be accomplished in the missile silos or in the equipment terminals which are located 30 or 40 ft. away and connected with them by a tunnel. Each of the nine firing silos has its own separate equipment and propellant terminals so that it can function independently during the preparation of the missile for firing. The silos are separated by several hundred feet of earth.

The firing silos are organized into three sections of three each. A separate control center and ground guidance system is provided for each section. Last action prior to launch that a crew in a silo takes before retiring behind blast proof doors is to prepare the missile for fueling. The fueling is handled automatically from the control center and, after this is completed, the 110-ton missile is raised to the surface. An umbilical tower will be raised at the same time to support the instrumentation and control leads needed during the final moments on the ground.

Ground Control

Antenna for the radar/command guidance system will have to be raised from their underground emplacements, and they will enable the missile to be controlled from the ground until its rocket motors burn out. It is possible that this type of guidance will be replaced in the future by a completely inertial system that does not require ground action after launching. The inertial system also would allow all nine missiles in a squadron to be launched simultaneously in a volley. With the radar/command system, a separate antenna system is required to launch each missile. Six of these antenna systems are provided with each squadron under present planning. New developments in this field may change the picture, however, and allow each ground guidance system with its antenna to guide more than one missile.

Two principal types of tunnels will be used to connect the various chambers in the complex, personnel and utility tunnels. The personnel tunnels will be smaller—about 10 ft. in diameter—and constructed primarily of steel.

Construction at Vandenberg Air Force Base which is now out for bids is similar in design to that for the operational complex at Lowry AFB. It consists primarily of the following:

- **Three operational type silos,** excluding the propellant loading systems.
- **Three equipment terminals.**
- **Three propellant terminals,** excluding the propellant loading systems.
- **Two antenna silos.**
- **One control center.**
- **Antenna terminal and pad.**
- **Two test mast bases** and orientation targets.

Bids on this work will be opened on Mar. 4, and 540 days will be allowed for its completion after the awarding of contracts which should occur toward the end of March.

Space Technology

House Unit Schedules Hearings To Probe U.S. Space 'Maze'

By Ford Eastman

Washington—Defense Department officials will soon be called before the House Committee on Science and Astronautics and asked to unravel the U.S. military space effort's "complex" organization and lines of authority, Rep. Overton Brooks (D.-La.) announced last week.

Decision to call Defense witnesses, including Secretary Neil H. McElroy, followed an explanation by Rear Adm. J. T. Hayward, Assistant Chief of Naval Operations for Research and Development, of the number of persons involved before any one proposal can be approved.

In response to questions by committee members, Adm. Hayward said there are at least 10 officials with authority to veto or approve proposals. These, he said, include fiscal officers who might not be technically qualified to weigh various considerations in the over-all picture. Adm. Hayward added that such procedures result in considerable delays before military services can obtain a definite decision on programs and plans.

Adding to the confusion as to just who has authority over what, was testimony given earlier before the Senate Committee on Aeronautical and Space Sciences by Dr. Herbert York, director of the Office of Defense Research and Engineering, and Roy W. Johnson, director of Defense Department's Advanced Research Projects Agency.

Johnson testified that he has complete authority to discharge duties and administer funds appropriated by Congress for Defense Department projects in the field of space, military technology, ballistic missile defense and solid propellant chemistry.

York said his authority calls for him to act as the principal advisor on technical matters to the Secretary of Defense, supervise all research and engineering in the Defense Department and direct and control such projects "deemed worthy of centralized control by our authority."

Adm. Hayward told the House committee that he felt there should be only one competent technical agency in charge of the over-all space program to accelerate the effort and cut decision times.

Another way to speed the space effort, Hayward said, is to accept a two-year budget cycle on research and development projects. This, he said, would accelerate the decision making process because, on a one-year basis, estimates for the next year's budget must be submitted before it is known what has been received for certain projects in the current budget.

Match Russia

Adm. Hayward also predicted the U.S. could match Russia in the ballistic missile field within a year if greater effort is put in this area. He said that, while the U.S. may be ahead of Russia "across the board," the country could be in serious trouble if the Soviet Union produces intercontinental ballistic missiles in quantity before the U.S. does

Nike Zeus Thrust

Washington—Thrust of 45,000 lb. has been attained for periods of four and one-half seconds during static tests of the solid-propellant powerplant for the Nike-Zeus anti-missile missile system, according to Maj. Gen. William W. Dick, Jr., director of special weapons in the Office of the Chief of Army Research and Development. Gen. Dick told the House Committee on Science and Astronautics last week that the thrust from the powerplant manufactured by Grand Central Rocket Co. would be sufficient to launch a missile at the speeds necessary to intercept an incoming ballistic nose cone.

Discoverer Satellite Nears Initial Launching

Artist's conception of Project Discoverer satellite research vehicle emphasizes the near north-south orbit it will take after firing from Vandenberg AFB, Calif. Vehicle in orbit will be entire second stage, which includes the Bell Hustler liquid propellant engine (using JP-4 and red fuming nitric acid) and the payload. Spheres on tail are for helium and nitrogen; helium is used to pressurize fuel for the engine. Initial experiments will be of general nature with data applicable to future space projects (AW Dec. 8, p. 31); first shot, scheduled before the end of February, will be for guidance, engine and Pacific Missile Range checkout. Discoverer will make a relatively low altitude orbit; high altitude orbit is not yet possible with the weight-to-thrust ratios established for the vehicle. Booster used to push the vehicle off the launch pad will be a Douglas Thor intermediate range ballistic missile; weight of the orbiting vehicle will be about 1,300 lb. No cameras will be carried in initial shot. Except for changes in payload makeup, Discoverer is essentially the same as USAF's WS-117L Sentry reconnaissance satellite (AW Nov. 24, p. 33). Advanced Research Projects Agency hopes to boost payload to 10,000 lb. this year. Previous attempt to launch Discoverer was postponed when rocket, fired to clear a pump, malfunctioned. One result was leakage of nitric acid down into the Thor booster (AW Feb. 2, p. 23). This booster may be replaced by another for the next shot, and damaged booster will be examined in detail to make sure acid did not etch the metal, causing damage

and, at the same time, develops a good defense against manned bombers.

Two Army special weapons officers also testifying at House Space Committee hearings last week, renewed the controversy over air defense which congressional probers are expected to pursue further.

Maj. Gen. Dwight E. Beach, Army air defense and special weapons director, and Maj. Gen. William W. Dick, Jr., director of special weapons, Office of Chief of Army Research and Development, said a program to produce the Nike-Zeus anti-missile missile has been turned down by the Defense Secretary Neil H. McElroy.

They said they had recommended, and been denied, $30 million for the program in the current fiscal year and an additional $700 million in Fiscal 1960 for construction of facilities to begin production of the Nike-Zeus.

Assistant Secretary of Defense W. J. McNeil later told a Joint Congressional Economic Committee that no project was being pushed harder than the Nike-Zeus program. He said the program has almost unlimited access to men and money in the effort to develop prototypes for test firing.

McNeil added, however, that the best scientific experts in the U.S. do not feel that the Nike-Zeus is far enough advanced to go into production.

Dick and Beach acknowledged that a difference of opinion exists within the Defense Department as to whether the Nike-Zeus is ready for production but added that they are convinced that it is and that the system, when deployed, will counter not only the ballistic missile threat but also can grow to meet the more sophisticated missiles of the future.

Gen. Dick, in a prepared statement read to the committee, said that during the course of the program several major technical breakthroughs have been achieved.

"For example," he said, "the successful implementation of a new technique in the radar field has made it possible for the first time to obtain very large volume coverages on large numbers of very small targets at very high data rates."

'Reorganize'

Washington—Rear Adm. J. T. Hayward, assistant chief of naval operations for research and development, when questioned last week by the House Space Committee about the various reorganizations under way in the Defense Department, replied:

"Well, there is a popular saying going around in the Pentagon today—If you can't cook it, kiss it or mimeograph it, you reorganize it."

Thompson Ramo Plans to Sever Ties With STL, Doolittle Says

Washington—Plans are under way to sever all business connections between Space Technology Laboratories and Thompson Ramo Wooldridge, according to James H. Doolittle, STL board chairman.

Doolittle told the House Military Operations Subcommittee investigating missile management programs that a complete divorce of the organizations is desirable but would depend upon several factors, including the government's attitude and the legal problems involved. He added the two organizations already are separate except for ownership and compilation of annual reports.

Relationship between the two organizations and the position of STL in the management of the Air Force ballistic missile program came under intense questioning by the subcommittee which is conducting a review of the organization and management of U.S. missile programs.

Rep. Chet Holifield (D.-Calif.) subcommittee chairman, said the purpose of the review is to determine whether the government is getting "the greatest possible return" on its missile investments. Emphasis will be placed on examination and evaluation of the basic differences between the Army "arsenal" system and the Air Force use of private industry.

Simon Ramo, Thompson Ramo Wooldridge executive vice president, defended the role of Ramo-Wooldridge Corp. (recently merged with Thompson Products) in the Air Force program but added he does not believe that the approach used in bringing in a private management firm provides a universal answer to the difficult problem of effectively mobilizing resources for all military programs.

Ramo pointed out that projects vary in size, degree of complexity, degree of reliance on new science and the amount of experience possessed by government and industry with the problems involved. Since all of these factors have to be taken into account each time a project is organized, Ramo said that neither industrial nor government groups can afford to become completely fixed in their concepts as to how the development of a weapon system is to be organized and directed.

He said flexibility in the approach to a new problem made possible the effective organizational structure created by the Air Force for its ballistic missile program approximately five years ago.

Considerable criticism has been leveled in the past by industry and congressional investigators at Space Technology Laboratories, wholly-owned, autonomous subsidiary of the merged Thompson Ramo Wooldridge, and its unique role in the Air Force ballistic missile program as a technical advisor and systems engineer.

Under its original contract with the Air Force, Ramo Wooldridge was excluded from participating—without prior approval of the Assistant Air Force Secretary for Materiel—in the production of missiles or components. When Ramo Wooldridge merged with Thompson Products and STL established, this exclusion was extended to the merged firm of Thompson Ramo Wooldridge.

Doolittle, who became chairman of STL on Jan. 1, praised the organization as "a fine, sound company that is unique in its excellence and is accomplishing a useful function." He added that he was convinced, even before joining the firm, that it was doing, and would continue to perform, a valuable service to the Air Force and the nation.

Ramo told the subcommittee that "it was clear that a crash program of unprecedented size would be required for development of ballistic missiles," to marshall the resources of industry, government, and science on a broader scale than had ever been previously attempted in peacetime. We had to extend every phase of the technical art—propulsion, electronics, materials and structures—by factors of 10 or more, simultaneously and on a schedule half or less of the time usually allowed for relatively modest advances in military weapon systems technology.

"We had to create major government facilities, widespread geographically, and start parallel development approaches to be sure that every problem was solved at the earliest possible moment. The scientific state of the art, the military problems and the industrial capability all had to be merged, and the management organization had to be capable of performing that merger if we were going to move at twice the speed of the normal program."

The work Space Technology Laboratories is currently doing under contract to the Air Force was outlined to the subcommittee by Louis G. Dunn, STL president. The categories are:

- **"System engineering and technical** direction of major weapon systems, such as Atlas, Titan, Thor, and Minuteman, which are characterized by a high order of technical difficulty and a great sense of schedule urgency.
- **"Laboratory experimental** work of an advanced nature to obtain technical information needed in making system engineering decisions, or to advance the state of the art in missile and space technology generally to provide the basis for future systems.
- **"Development of airborne** and ground tracking hardware for special space flight experiments, such as the recent lunar probe experiments carried out for the Air Force and the National Aeronautics and Space Administration.
- **"Technical staff assistance** to the Air Force, including analysis of potential new ballistic missile and space systems and certain special tasks such as the analysis of intelligence data and the training of Air Force officers.
- **"Non-technical support** to the Air Force group locally resident at the Air Force Ballistic Missile Division and STL in the form of plant maintenance services, heat, light, and power, publication services. . . ."

USAF High Altitude Research Project

Los Angeles—Air Force Special Weapons Center, Kirtland AFB, N. M., announced completion of a "scientific research project involving the launching of five-stage solid propellant rockets to investigate radiation at high altitudes."

Although not identified, details of this high-altitude sounding rocket were first reported by Aviation Week as Project Jason (AW July 7, p. 26).

The project took less than three months to finish, and actual Jason firings were completed in September, 1958, Aviation Week has learned.

Sixteen successful launchings were made at three different sites—Cape Canaveral, Fla., Wallops Island, Va., and Ramey AFB, Puerto Rico—according to the Special Weapons Center which declared that the project was undertaken to further define the corpuscular radiation levels in the outermost fringe of the atmosphere.

Basic research information gathered by the rockets is expected to be applicable to many defense projects, including manned space travel.

Each rocket carried a 60-lb. package of battery-operated radiation measuring devices developed by Lockheed Missile Systems Division.

Average altitude reached was 550 mi., covering a down-range distance of nearly 600 mi. Speed of each rocket's final stage was between Mach 12 and 14.

Prime contractor for the project was Aerolab Development Co., Inc., Pasadena, Calif., which supplied the high altitude sounding rockets, measuring 57 ft. long and weighing 7,000 lb., modified to convert hypersonic capability to altitude potential.

Quarles Sparks Nuclear Plane Debate

By Katherine Johnsen

Washington—Public hearings on the status of the U.S. nuclear aircraft program as opposed to Soviet progress in this field will be held by the Joint Congressional Atomic Energy Committee within the near future—probably the first week of March.

The sessions were scheduled following an exchange of charges and counter charges between the committee leadership and Deputy Secretary of Defense Donald Quarles which culminated a long-standing controversy over Quarles' refusal to support a "fly early" subsonic prototype of a nuclear aircraft.

AVIATION WEEK reported in an exclusive story last Dec. 1 (p. 26) that the Soviet Union already has begun initial test flights of a nuclear-powered bomber. More recently, Col. Leonard Harmon (USAF, ret.), of General Electric's Aircraft Nuclear Propulsion Department, said "there is every reason to believe the Russians are flying nuclear-powered aircraft." (AW Feb. 9, p. 28).

Sen. Clinton Anderson (D.-N. M.), chairman of the Joint Congressional Atomic Energy Committee, has charged that the U.S. will not have an atomic-powered aircraft flying until sometime in the 1970s if the present Administration plan continues in force. Defense Secretary Neil H. McElroy says the U.S. should have a nuclear plane in the air in approximately five years under present planning (AW Feb. 9, p. 28).

Within a two-day period, there were these developments:

• **Sen. Anderson,** Rep. Carl Durham (D.-N. C.), vice chairman of the committee, and Rep. Melvin Price (D.-Ill.), chairman of the research and development subcommittee, issued a statement declaring that a series of closed-door briefing sessions on the nuclear plane program "left us gravely concerned." The legislators challenged the Administration to present "a forthright statement as to whether it intends to set a target date now for the successful achievement of nuclear flight or whether the taxpayer is going to be asked to continue to foot the bill for administrative indecision."

• **Quarles countered** with a press release defending the go-slow approach which requires $150 million a year support even though "the Soviets might choose the more spectacular early flight course. If they do so at this time by building a plane of such low flight performance as to be militarily useless, we can take some satisfaction in the fact that they will have wasted some of their resources."

Quarles also questioned the congressional committee's tactics, declaring: "At the end of a closed hearing in which associates and I presented . . . . the Administration's program . . . . we were handed a mimeographed 'Immediate Release' statement by three members. . . ."

In announcing plans for the public sessions, Rep. Price said:

"If the Department of Defense feels that committee criticism of the conduct of the ANP program is unwarranted, I think the best course for us to follow is to lay the facts out on the table in a public hearing and let the chips fall where they may. For 10 long years the committee has been pressing the Defense Department and the Atomic Energy Commission to get on with the job of developing a flying prototype of a nuclear-powered aircraft and has urged time and again that difficult technical and administrative decisions be made so that the program can move forward vigorously.

"During this extended period the committee has respected the desires of the executive branch that our hearings on the ANP project be held behind closed doors because of the classified nature of the technical information presented.

"But if we are going to be charged with 'hitting below the belt' and misleading the public, I think it is high time the American public be given the opportunity to hear the true facts of the situation and make their own judgment as to who has been misleading whom for the past decade.

"I believe the basic facts can now be discussed without danger to the national security. In fact, I think the national security will be well served by public discussion of the program which has important implications for the national security and for world confidence in America's scientific capabilities."

The accelerated program supported by Anderson, Durham, and Price would set a target date of mid-1962 for a subsonic flying model. A reactor-engine combination would be ground-tested in mid-1960. Over the four-year period, the program would cost $280 million more than the present Administration program, under which the ground vehicle would be tested in mid-1961.

Following are points made in the Anderson-Durham-Price statement:

• **"The program still has** no firm set of objectives looking toward the development of a nuclear propelled aircraft.

• **"No decision has been made** regarding actual nuclear flight and no target dates have been set for such flight.

• **"Recommendations of the project** director as to funding levels required to get the job done have been virtually ignored.

• **"It is authoritatively estimated** that cuts in proposed funding levels for the program in Fiscal 1960 will delay the achievement of a ground test prototype for an additional year and will thereby delay achievement of nuclear flight for at least that period of time.

• **"Administrative indecision** at high levels and interservice rivalries have plagued the program from the start and have rendered a great disservice to the nation.

• **"No less than seven advisory** committees have been set up in the past decade to review the program, including the so-called Killian Committee, and yet the contractors in the field still have no clear guidance as to where they stand or where the program is going.

• **"The annual expenditure** of $150 million for the ANP program as a holding operation to avoid difficult technical and administrative decisions which must be made to lend clear-cut direction to the program is a completely indefensible use of the taxpayers' money.

• **"The Air Force and the Navy,** after due consideration by their expert mili-

ASW Competition

Washington—Navy selection of a new anti-submarine aircraft probably will be made within two weeks. Two proposals receiving major consideration are a modification of the Canadair CL-28 Argus and a new design by Boeing. Navy ASW mission requirements include unrefueled flights of more than 24 hr., most of them at altitudes of less than 500 ft.

Plato Canceled

Washington—Department of Defense announced last week that the Plato transportable, anti-ballistic missile system has not received any funds since the end of Fiscal 1958, last June 30, and that no further development is planned.

Originally an Army project to develop a ballistic missile defense for front-line troops, Plato was transferred last year to Defense Department's Advanced Research Projects Agency. Sylvania Electric Products, Inc. has been the prime contractor on Plato. Some Defense Department officials say that the present Plato concept already has been outmoded by new developments. The Army says that Plato has made "a very substantial contribution to the state-of-the-art of ballistic missile defense."

tary advisers, have established firm requirements for nuclear-propelled aircraft. The Air Force and AEC both recommended an increase in their own Fiscal 1960 budgets for the program to back up these requirements, but have been turned down."

• **"We believe it is essential** to decide, and decide now, on a program to achieve early nuclear flight. Any other course, in our view, is dangerous to the national security, wasteful of the taxpayers' dollar and indefensible in the eyes of the American people."

This was Quarles reply:

"The basic issue is whether we should concentrate, as our program does, on the solution of the fundamental problems involved in creating a nuclear reactor of such compactness and efficiency as to be useful in a propulsion system for a military aircraft, or whether, in addition to this necessary basic work, we should have a so-called early flight program which would apply current technology and admittedly be too limited in operational characteristics to fulfill a useful military mission.

"The present program was adopted by the Administration after most careful consideration of the fundamental scientific and technical problems involved. While there have been differences of opinion, most of the scientists and engineers who have been called in to review the program have advised that it would be unwise to undertake the early flight program until more progress had been made on the development of a reactor that would meet the military requirements.

"The present program gives high priority support to two alternative attacks on the fundamental propulsion problems. Progress along these fundamental lines, while impressive, has encountered substantial obstacles. It has been paced by science and technology rather than by funding.

"The allegation in the 'Immediate Release' that 'Administrative indecision at high levels and interservice rivalries have plagued the program from the start' is, so far as I know, without foundation in fact. While the 10 or so years' history of this program has been marked by changes in course as the science and technology unfolded, timely administrative decisions have been and are being made. On best technical advice, they have been wisely made and in the national interest. Contrary to allegations, target dates for tests of ground prototypes have been established and were presented to the committee. Target dates for nuclear flight will be established as soon as there is a sound basis for doing so.

"That ANP is a strong, high priority program is evidenced by the decision of the Administration to invest some $150 million a year in it. The program assumes that as soon as there is a valid basis for passing from the present propulsion development phase to a weapon system development phase, this will be done.

"As regards the allegation that the administration's program is a 'waste of the taxpayer's money,' there seems to be no question on the part of the committee that the whole program proposed by the Administration should be carried out and that budgeted funds are properly applied to it. The 'Immediate Release' advocates an early flight program over and above the Administration's program involving additional expenditures of the order of $50 million to $100 million a year. The real question is not whether the present program is a waste of the taxpayer's money, but whether the added early flight program would involve such waste. . . ."

Germans Sign F-104 Agreement

By David A. Anderton

Geneva—West German Defense Ministry has finally bought 96 Lockheed F-104 Starfighters and has signed agreements for construction of about 200 more by the German aircraft industry.

Total price for 300 airplanes will be $375 million. The Germans say "the Starfighters will suit our military requirements until 1966."

The decision climaxes almost two years of off-again, on-again German negotiations with four countries, and paper evaluations or flight tests of 13 different airplanes.

The German Starfighter order is broken down into six development aircraft, which will probably be delivered first and used for pilot qualification as well as modification and development test flying.

These will be followed by 30 two-seat trainers, basically an F-104B configuration, but with what the Germans say will be the ". . . latest 1961 equipment."

Deliveries are obviously scheduled for 1961.

Remainder of 60 Starfighters, possibly to bear an F-104D designation, will have standard airframe-engine configuration, but will differ in armament and avionic gear from any of the USAF Starfighters.

Negotiations for German production of the Starfighter's General Electric J79 turbojet engine are still proceeding. Quantity to be ordered will depend on German acceptance of necessity to order the proper number of spare engines and on the estimated lead time required to get the J79 into license production. Final total could be between 200 and 300 purchased engines.

Following the talks with Lockheed and General Electric, the German Defense Ministry is expected to negotiate with the Italian company, Fiat S. P. A., for purchase and production of the G.91 lightweight strike fighter. German decision to buy 50 and build 150 of these aircraft was announced along with the F-104 decision last November (AW Nov. 10, p. 33).

All licenses are being negotiated between the Defense Ministry and the original manufacturers directly, with the German industry sitting on the sidelines and waiting impatiently for its chance to play. Licenses will be held by the Defense Ministry and work on the airplanes and engines will be portioned out among the reborn aircraft industry, presumably after discussions with its leaders.

Now the industry faces its toughest task since its amazing increase of unit production during the heaviest bombing of World War II: simultaneous production of the Fiat G.91, the Lockheed F-104 and the General Electric J79 turbojet.

Production of the two planes will be the responsibility of three companies in the south of Germany—Dornier Werke GmbH, Ernst Heinkel Fahrzeugbau GmbH, and Messerschmitt A. G.—following the government's basic policy of locating fighter production in the "Bavarian redoubt," a philosophy carried over from wartime planning and conceptually obsolete today.

Task of building the J79 is expected to go to Bayrische Motoren Werke (BMW) as prime contractor, with the automotive industry sharing in the component work.

So far the companies concerned have been able to do only sketchy preliminary planning, partly on faith, but largely on the certain knowledge that there was nobody else in Germany to do the job anyway. Messerschmitt, for example, has a new assembly area under construction, scheduled for completion next year, which will replace its two separated assembly areas with one single unit. Planners from the three companies have been working on preliminary layouts for factory floors and attempting to estimate material requirements.

Current size of the entire German aircraft industry is about 10,000 persons in all grades of skills. This is approximately one-sixth the number of people employed by Lockheed alone, or about the same size as Temco. Of this force, less than half is available in the southern companies, where individual employment is on the order of 1,000 total per company.

Space Technology

USAF Developing Animal Space Capsules

By Craig Lewis

San Antonio—Family of space capsules to carry animals on biological research flights is under development here at the Air Force School of Aviation Medicine.

Capsule work involves development of animal enclosures and the medical equipment needed to maintain and test the animals. These biological capsules are variously designed to accommodate mice and primates, and they are built to be plugged into launch vehicle nose cones for use in such programs as Project Discoverer.

Units already developed include a 12-15 lb. payload capsule that carries four mice and a 57 lb. payload Bio-pac that carries a Rhesus monkey weighing four to six pounds. Scientists are now developing a 100 lb. payload unit that can either increase the variety of measurements made on a small monkey or carry a bigger subject, such as a chimpanzee.

Smallest unit is a cylinder that can carry four mice. Electrocardiogram and respiratory measurements can be taken, but the mice cannot be tested in any way to measure proficiency or other factors.

Larger Bio-pac now ready for use accommodates a monkey and has a capability for simple psychomotor testing of the type where the animal is trained to pull a lever in response to a signal light. Bio-pac also can telemeter data on heart and respiratory condition, and it has a feeding mechanism.

Research is now being done in a ground test chamber to determine the physiological parameters of the chimpanzee. This information will be used in the design of the largest unit and will dictate the size of the various systems used to maintain a livable environment in the chimp capsule.

Couches used to hold the monkeys in place are glass fiber with a foam rubber lining. They are a universal type which can be adapted for any size primate, but each couch is specifically tailored to the individual primate that will use it. The animal is restrained in the couch by a cloth jacket that covers its open front but its hands are free to perform tests and eat.

Capsule Equipment

The Bio-pac with the 100-lb. payload will accommodate a 26-28 lb. chimpanzee and telemeter a few simple biological measurements, or it will take a much smaller monkey with the equipment to measure a greater number of physiological factors. A typical capsule with a small monkey might include a camera, microphone, psychomotor programer for testing, oxygen sensor, temperature sensor and other equipment.

A timing system is needed in such capsules to parcel out meals at planned intervals, but ordinary timing devices often fail during acceleration and zero gravity conditions. Scientists here have developed a system in which a spring-loaded plunger presses on a block of silicone-type material.

This material resists sudden plunger motion, but it permits slow penetration. While the plunger is slowly working its way through the material at a known rate, it activates a rachet mechanism which periodically presents a compartment full of food to the animal.

Biological test packages and the animals in them are tailored for a specific mission. When the mission profile is known, an animal is selected for the job, and the test unit is tailored both to the test subject and to the mission profile. Primates have to be trained and

XQ-2C Firebee Drone Makes Flight

Air Force's Ryan XQ-2C Firebee made a 26-min. test flight at Holloman AFB, N. M., and was recovered by parachute after attaining an altitude of 46,000 ft. Fairing on top of the remote-controlled jet target drone contains fuel tank vents and encloses a groove which contains parachute risers of nylon webbing for shroud lines. Firebee tail cone contains twin parachute for landing the drone in a horizontal attitude. The XQ-2C is powered by a Continental J69-T-29 turbojet (1,700 lb. thrust); the Q-2A is powered by a Continental J69-T-19B (1,060 lb. thrust). XQ-2C's nose will house avionic gear (AW Nov. 17, p. 63).

used fairly quickly, since the four to six pound Rhesus monkey is only 9-10 months old and will eventually grow as large as 25 lb. and be too large for the capsule. The same thing applies to chimpanzees.

U.S. Navaid Gains ICAO Support

By James A. Fusca

Montreal, Can.—United States proposal that its VOR/DME-T short distance navigation aid be adopted as an international standard is gaining increasing support at the special meeting here of the International Civil Aviation Organization, called to settle competition between the British Decca hyperbolic system and the U. S. point source navigation system.

Both the British and the U. S. delegations, however, are locked in a battle of technical debates and political maneuvers that will leave the outcome undecided until a final vote is taken among the 34 ICAO member states and the three international organizations attending. The meeting is expected to continue for two more weeks.

As predicted by AVIATION WEEK (Feb. 2, p. 34), significant support for the U. S. proposal came from the International Air Transport Assn. when that organization declared itself in favor of the VOR/DME-T system. (VOR is VHF omnirange; DME-T is distance measuring equipment, Tacan.)

The additional support being given the U. S. position has caused the British to modify their proposal from favoring Decca being used in conjunction with VOR but without DME-T. At present, it appears that the British will fight the adoption of DME-T vigorously for political reasons during the early sessions. The purpose of this will not be to defeat adoption of DME-T, which seems certain to be accepted, but to allow the British delegation to offer as a compromise acceptance of DME-T as an international standard if Decca also will be accepted.

If this is done, it will be aimed at placing the U. S.—already committed to opposing the compromise of a dual navaid standard—in the embarrassing position of appearing arbitrary and unreasonable. The U. S., on the other hand, is expected to attempt to counter such a move by offering what it considers to be valid technical objections to the Decca system, which it believes the British delegation will not be able to dispute.

Two key delegations that may have an effect on the final vote are France and Germany. Both countries have Decca chains in operation now, and have experience in operating Decca airborne equipment. These countries are not believed to favor the British position but may go along with the proposal of a dual DME-T and Decca standard.

N-156 Finance Plan

Air Force and Northrop Corp. are about to negotiate financing of a development program for the N-156F lightweight counter-air fighter for sale to NATO and SEATO air forces. Officials expect that Air Force backing will stimulate sale of the aircraft which was designed to meet the needs of allied countries and not to a USAF requirement. They believe it will improve allied capability and minimize the military assistance required. Northrop reports that 26 countries have shown an interest in the N-156F. The company has been financing N-156F development in a program parallel to that of USAF's T-38. First flight is planned for mid-summer.

News Digest

Strike threat by 8,100 Transport Workers Union members employed by Pan American World Airways followed vote by the mechanics, flight service, ground crew and clerical workers involved. Legal cooling-off period ends Mar. 2 and strike could follow. Mechanics' demands include a shorter work week; airline has offered wage increase. Showdown could be delayed by appointment of a presidential fact-finding board.

Short Brothers & Harland has won a Royal Air Force contract for production of unspecified number of Mark 3 Britannic turboprop strategic freighter. Aircraft retains same wing and systems as Britannia, but has fuselage 17 ft., 6 in., in diameter; powerplants are four Rolls-Royce Tyne engines.

James W. Austin, president of Northeast Airlines, has been named general manager, in addition to his present post, with full charge of all operations, sales and fiscal activities. Directors also elected David A. Stretch chairman of the board, succeeding George E. Gardner who will retain his directorship and will become vice president of Atlas, Northeast's majority stockholder.

Freidrich L. von Doblhoff, chief engineer of McDonnell Aircraft's Helicopter Division for almost 10 years has joined Vertol Aircraft Corp. as vice president in charge of foreign sales and will be stationed in Europe. Marvin Marks will move into the chief helicopter engineer post at McDonnell with no major changes planned in the company's rotary wing program. Von Doblhoff was the principal engineer of first pressure jet helicopter which was built in Germany during World War II. He was employed by the Air Force at Wright-Patterson AFB, Ohio, from 1946 to 1950 before joining McDonnell where he was instrumental in the firm's work with hot-pressure jet rotors.

McDonnell Model 119 UCX utility jet transport-trainer last week made its first flight of 45 min. at McDonnell Aircraft plant at St. Louis, Mo. Aircraft, powered by four Westinghouse J34 turbojet engines (AW Feb. 9, p. 32), is a candidate in the Air Force UCX competition.

Fred A. Hamlin, 53, assistant to the publisher of "The Pilot," official publication of the Aircraft Owners and Pilots Assn., died in Washington last week after a short illness. Prior to joining "The Pilot," Hamlin had been president of Lincoln Press and editor and published of the former "Aero Digest" magazine. He also had served as director of public information for the Civil Aeronautics Administration.

National Aeronautics and Space Administration will close its liaison office at Wright-Patterson AFB, Dayton, Ohio, on about April 1. Because of "the growing diversity of research project details which the one-man office can no longer adequately handle," NASA says that in the future it will rely primarily upon visits of technical specialists to Wright-Patterson and other USAF research centers. William J. Underwood, project officer at Wright-Patterson since 1948, has been appointed assistant to the chairman of the Civilian-Military Liaison Committee.

Riddle Airlines expects to sign a firm contract this week for a new fleet of Armstrong-Whitworth 650 turboprop cargo carriers. Officials of the all-cargo carrier were completing a final cost and specification study of the new British aircraft late last week.

First units of battery-powered television system, weighing only 9 lb. and capable of withstanding forces of being rocketed into space, have been delivered to Army Ballistic Missile Agency by Lockheed Missiles and Space Division, Sunnyvale, Calif. System has 1,000 mi. transmitting range and picture transmission quality comparable to commercial TV cameras and transmitting stations. Camera is 7¾ in. long by 2¼ in. in diameter, weighs 42 oz., including lens.

FAA Removes Electra Flight Restraints

Limitations imposed after New York crash lifted as American, Eastern install standard altimeter.

By L. L. Doty

Washington—Operating restrictions imposed by the Federal Aviation Agency on the Lockheed Electra 188 turboprop transport were removed last week following reinstallation of the standard Kollsman altimeter on the airplane by American Airlines and Eastern Air Lines.

Five days after an American Airlines' Electra crashed during an approach to New York's LaGuardia Field on Feb. 3 (AW Feb. 9, p. 38), FAA limited landings of the Electra to flight minimums of 1,000 ft. ceilings and one mile visibility during daylight hours and two miles at night. Federal Aviation Agency authorities have emphasized that the restriction had no relation to findings thus far in the investigation of the American accident.

According to one FAA official, the restriction was "placed on the airplane because of the number of failure incidents reported" on the new drum-type altimeter with which the aircraft is equipped. The new altimeter is manufactured by Kollsman and is also used on the Boeing 707-120 series now operated by Pan American and American.

Tendency of the altimeter needle to "stick" prompted the FAA to place the weather restrictions on the Electra. The agency said it would lift these restrictions if the new type instruments were replaced by the standard altimeter or after an investigation and analysis of the "operating difficulties encountered with the new instrument" pointed to ways of correcting the problem.

Original weather restrictions were modified by the FAA to this degree: Electras equipped with the drum-type altimeter could land at airports under normal restrictions if the field were equipped with precision approach radar (PAR) and if the front course only of the instrument landing system (ILS) —that which includes the glide path— were used. American conducts all its Boeing turbojet operations under the same but self-imposed limitations.

On Tuesday, Federal Aviation Agency announced its decision to lift the restrictions if the altimeters were changed. Eastern Air Lines, which has a fleet of 15 Electras, began changing altimeters Monday and was ready to resume normal service when the agency announcement was made. American began making the switch the same day and returned to standard operating procedures shortly thereafter.

Early last week, FAA considered putting similar restrictions on the Boeing turbojet since it also is equipped with the drum-type altimeter. However, no operating difficulties with the instrument's needle have been reported to the agency in connection with the Boeing flights. In addition, Kollsman Instrument Corp. officials demonstrated to the FAA that the needles used on Boeing altimeters are protected against sticking through the use of a "vibrator" installed with the instrument.

Both the new and old instruments are precision diaphragm-actuated altitude instruments with barometric scales. Chief difference lies in the presentation of altitude information to the flight crew.

The new instrument records altitude data in hundreds of feet by a pointer on the dial and in thousands of feet on a rotating drum. The old instrument uses three pointers: one for hundreds of feet, a second for thousands of feet and a third for altitudes in ten thousands of feet.

The new instrument was developed as a result of studies made by Aero Medical Laboratories at the instigation of the Air Force. Purpose of redesigning the old instrument, which is still standard equipment on piston engine transports, was to build an instrument that would be easier to read because of the need for fast and accurate eye-reading at high speeds of jet aircraft.

However, the new drum-type altimeter has been the target of airline pilots ever since it was introduced. Pilots are charging that the instrument is difficult to read and that the drum gage can actually cause a misreading of the altitude information.

Here is what the Air Line Pilots Assn. has to say in its evaluation report of the Boeing 707: "The altimeter on the flight panel, said to be the same on all air carrier contract orders, is unacceptable. It is easily misread and misleading in its information display. The airspeed that is said to become standard presentation is also inadequate."

In connection with approach procedures, ALPA, in its report on the Boeing, said, "The cockpit duties during ILS approaches requires undivided attention, without interruption for other than minor functions. Duties of the captain and first officer should under no circumstances be diverted to other than the approach itself."

Although the FAA has taken full cognizance of the protests against the instrument design, the pilots' stand is not directly responsible for the restriction on the altimeter. However, the investigation and analysis of the altimeter may result in a change in design after the needle malfunction is corrected.

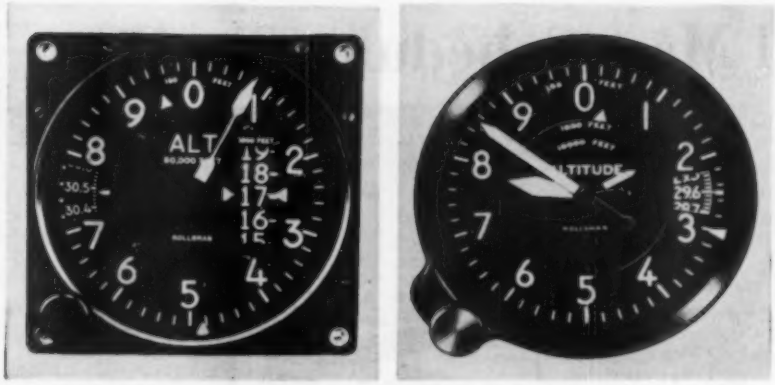
Eastern emphasized that its action in changing the altimeter was in no way an implication that blame for the accident could be placed on the instrument. It added that the modification was the quickest way of getting the Electras back into service without restrictions.

American said that the action "in no way represents the conclusion as to whether the present altimeter was involved in the recent accident."

IATA Deadlocked

Paris—Top officials of world airlines reportedly remain deadlocked over the question of a jet surcharge on North Atlantic routes. In the middle of last week, after three days of talks behind closed doors, no agreement was in sight. However, some sources indicated that the International Air Transport Assn. Paris conference atmosphere is "more compromising" than at the previous attempt last fall to break the deadlock. Several other fare questions are also involved in the current Paris talks, including cargo rates over the North Atlantic. Some of these matters were settled in principle last fall, when IATA carriers met for four weeks at Cannes, but no details are expected to be announced until the jet surcharge issue is settled.

IATA members must agree on a new fare structure by April 1, when present fares expire, or else rely on their individual governments to settle the question for them. Fear of this happening probably accounts for the reported conciliatory atmosphere in current talks.



DRUM-POINTER altimeter (left) is a new presentation introduced on the Lockheed Electra and the Boeing 707-120 and due to be production equipment in Douglas DC-8s and Convair 880s. This altimeter could be misread in 1,000-ft. increments but is considered easier to read than the three-handed altimeter (right) which could be misread by 10,000-ft.

Crash of Electra May Accelerate Studies to Improve Pilot Display

By Richard Sweeney

Los Angeles—Inadequacies of pilot displays, long known to exist and the subject of much research and debate, were forcefully brought out again following the crash of the American Airlines' Lockheed Electra near New York's LaGuardia Field.

First result was a hasty "quick fix," but indications last week were that perhaps some real steps would be taken to cure the trouble at the source.

In this crash, questions centered around the drum-pointer altimeter, a new presentation introduced on the Electra, Boeing's 707-120 and due to be production equipment in Douglas DC-8s, and Convair 880s as well.

Two points about the altimeter were questioned as a result of preliminary crash investigation—had the altimeter stuck or had the pilot misread the gage?

Misreading

The drum pointer altimeter is subject to misreading in 1,000-ft. increments. It is better in many ways than the old three-handed clock, which was many times misread by 10,000 ft.

Reports of misreadings of this altimeter were given this AVIATION WEEK pilot many times before the instrument went into service. In his own flight work with the instrument—in the Boeing 707 and Lockheed Electra—he never misread the altimeter, but there were many cases in which a second glance was taken to double check readings—most especially in the low altitude regimes such as ILS approaches.

The fix which has been made, which restored the Electras to normal operation, consisted of the installation of the old three-handed altimeter as a third altimeter in the cockpit.

Question of ambiguity in readings of the drum-pointer unit have been raised by test pilots, military pilots, evaluation pilots and, after the instrument went into service, airline pilots.

Mechanical performance of the instrument was faultless according to the specification while this pilot was using the instrument.

Similarly, mechanical performance throughout test programs on both the 707 and the Electra also was reported as faultless.

Altimeter may or may not have been a primary cause of the crash—most crashes are the result of many little things reacting cumulatively.

Regarding pilot displays, millions of dollars have gone into research and development. Wright Air Development Center and Army-Navy Instrument Program have been under way for quite some time, but there is a paucity of flyable hardware. Commercial companies have worked on integrated displays and each has come up with a different answer substantiated by reams of pilot opinion, psychological research and even some flight test data.

The commercial displays are going into airplanes—707, DC-8, Electra and 880. All the units which make up these displays, the attitude indicators, horizontal situation gages, airspeed gages, altimeters, rate instruments, even the clocks, are extensions of ancient hardware, updated but still a generation behind the airplanes when all the gages that make up a pilot's panel are counted in. Some, it is true, are farther ahead than others.

Last week, this pilot was invited to fly the Bulova altimeter. This gage was given a fair aerial evaluation in maneuvers, accelerations, combinations of accelerations, decelerations, sinusoidal inputs, lateral accelerations. Instrument accuracy remained intact through these.

Clearly Readable

But the best point of this instrument was that it at all times was clearly readable, nonambiguous. It was prototype hardware in that such details as black on white, lighting, are not completely firmed. But its performance was excellent in the essential area of readability and nonambiguity.

Unit makes use of fixed index and moving tape principle, and is an inherent part of the Wright Air Development instrument panel concept.

It reportedly costs more than current altimeters.

Much time and money has been spent on pilot instruments. The reports written up in technical papers presented at various society meetings do not yet seem to be available in the form of production hardware for installation in today's turbine-powered airplanes.

Eastern and Capital Report 1958 Profits

New York—Eastern Air Lines and Capital Airlines, both hit by strikes last year, have reported profits on 1958 operations.

Eastern's net after taxes was about $7 million for the year, down from $9,378,000 in 1957. Unusually cold Florida weather in early 1958, which occurred during the normal peak traffic period, was cited by Eastern in addition to the holiday season strike as a major factor in the reduced profit. The airline's 1958 operating revenues totaled $246,228,000, down from $262,477,000 in 1957; operating expenses totaled $234,950,000, compared with $251,798,000 in 1957.

Capital's 1958 net profit of $213,262 compared with a net 1957 loss of $3,210,355. Operating revenues were $95,520,182 last year, up from $94,060,857; operating expenses totaled $92,461,993, down from $94,018,817 in 1957.

880 Flight Testing Ahead of Schedule

Los Angeles—First phase of Convair's flight test program on the 880 jet airliner has been completed nine days ahead of schedule. Don Germeraad, chief engineering test pilot, was at the controls on the seventh flight, a 2 hr. 2 min. hop made to test the jet aircraft's emergency fuel jettisoning system.

North Central Mass-Schedules Traffic

By Robert H. Cook

Minneapolis—Philosophy behind the rise of North Central Airlines as a leader of the nation's 13 local-service carriers centers about President Hal N. Carr's prescription of mass production flight schedules as a means of rejuvenating unproductive traffic areas.

Operating over a route system with an average length of haul of only 78 mi. and some as small as 28 mi., with high-cost low capacity Douglas DC-3s, the carrier has experienced a steady rise of traffic in the past four years since Carr assumed the presidency.

Last year, the airline boarded 777,140 passengers for a 14% increase over 1957. Emphasis on commuter type flight schedules produced a 19% gain in revenue miles flown, totaling 11,260,865 for last year, and a 10% increase in revenue passenger miles at 117,573,865. Heavy gains also were recorded for ton miles of mail, 302,131, up 14% over 1957, and air express ton miles, 406,476, up 12% over the previous year.

At the same time, North Central's performance factor of 98.2% remained one of the highest in the industry. Carr adds that the airline's on-schedule arrival record of 78.7% is "exceptional" in view of the often severe weather conditions prevailing over the carrier's route system.

Mass Scheduling

This year, North Central anticipates that it will carry one million passengers through utilization of its mass scheduling principle. Scheduling on many segments will be expanded by the use of five Convair 340s now being delivered, and the airline is extending its route system to 4,987 mi. by the addition of 17 new cities awarded in the recent Seven States Area Case. Carr said the airline will inaugurate service to 11 of the new points in North Dakota, South Dakota and Minnesota on Mar. 1.

Hal N. Carr

FUSELAGE of North Central's Convair 340s will be painted heat-reflecting white, with the airline's name in blue lettering. Headdress motif around cockpit will be red. Registration number, formerly carried on wing and tail surfaces, will be painted in 12-in. figures on the fuselage just forward of the horizontal stabilizer.

Carr explains his philosophy of making the most use of the carrier's fleet of 32 DC-3s, which have an average daily utilization rate of 7.3 hr., by saying that "they don't make money on the ground."

Prime example of the thinking behind mass scheduling is the carrier's 28-mi. Milwaukee-Chicago segment in competition with Northwest and American Airlines. North Central provides 53 flights a day in this market area and claims 85% of the business.

When applied to less productive points, the mass scheduling policy has significantly increased load factors. North Central flights from Oshkosh, Wis., formerly held to eight a day with an average of three passengers per flight, were increased to 15 a day resulting in average payloads per flight of 5.2 passengers.

Service at Duluth, Minn., once held to eight daily flights averaging six passengers per flight, was increased to 24 flights a day producing 7.3 passengers per flight.

Carr says that, while the mass scheduling principle already has paid significant dividends, its greatest vindication may come in the years ahead. He adds that the need for more and better flight service to smaller communities has been intensified by decreasing rail service, decentralization of industry to rural centers and an attendant population growth which should have the combined effect of expanding North Central's traffic potential.

Today, the airline has from 12 to 15,000 departures a month and flys approximately one million plane miles each month as compared with 300,000 in 1953. While this tripling of volume might be expected to increase maintenance and operational problems, North Central's management has succeeded in cutting expenses in nearly every phase of operation. Five years ago, delays were averaging 60 a month as compared with only 21 last month. Average system load factor stood at 45.42% last year with 13 unscheduled engine changes in 160,332 engine hours. Direct operating costs per plane mile were 52 cents, flying operation costs 37.2 cents.

Higher Capacity

Use of the 44-passenger Convairs will give the carrier better flight frequency and higher capacity. First of the new aircraft has been delivered with the balance expected by late April. Initially, the aircraft will be used on high-density routes such as Duluth-Chicago nonstop route which last year produced a 60% load factor.

Carr points out that the DC-3 load factor was severely limited on this route by fuel load requirements. With its longer range, the Convair will have all seats available, and, assuming it retains the same 60% load factor, Carr said the new plane should increase traffic by 36,000 passengers a year between the two cities.

Cost analysis studies on the Convair indicate that North Central may expect direct operating costs per plane mile of 94 cents. Direct seat mile costs should be 2.1 cents as compared with 2.5 cents for the industry average for DC-3 air-

craft. Passenger load factor needed to meet direct costs has been estimated at 29% as compared with 34% for average DC-3 operations by local-service carriers.

Carr says he favors the Convair over the Fairchild F-27 turboprop because of the former's higher seating capacity which he says may be increased in the future.

However, he is considering the possibility of converting the Convairs to turboprops by utilizing Napier Eland or Allison kits.

Napier says its studies indicate a conversion cost of $400,000 per plane, with the changeover estimated to increase the aircraft's earning power by $350,000 per year based upon an increased block speed of 50 mph., 3,000 hr. utilization and a revenue rate of six cents per seat mile.

Purchased from Continental Air Lines at a cost of $2,340,000, including spare parts, the new planes are radar equipped and pressurized and will be fitted with exhaust muffler kits designed to reduce engine noise by 45%. Cost of the planes was included in a $4,340,000 financing program completed last month by North Central.

The airline still hopes to acquire Lake Central Airlines, although the plans were rejected by the Civil Aeronautics Board and the decision was upheld last month by the U. S. Court of Appeals for the District of Columbia. Attorneys for North Central have taken legal action to carry the case to the U. S. Supreme Court.

Senate Airport Aid Bill Proposes $100 Million in Annual Spending

Washington—The Senate by an overwhelming 63 to 22 vote has passed legislation authorizing $100 million a year in federal airport aid over the next four years.

The House Commerce Committee started hearings on the measure last week.

The Senate bill also provides a $65 million "emergency" fund to get the expansion program under way immediately.

The $465 million total is more than a third of the total $1.29 billion that Federal Aviation Agency estimates will be required for airport financing over the four year period—$1.011 million for commercial airports and $279 million for general aviation projects. This would leave a total $825 million for local financing.

The President vetoed legislation authorizing $500 million in federal airport aid—$100 million a year for five years—after Congress adjourned last year (AW Sept. 15, p. 28).

The Administration's program providing a total $200 million in federal airport aid over the next four years and a complete withdrawal of federal assistance at the end of that time found no support in the Senate (AW Feb. 2, p. 45).

Before Senate passage of the $465 million measure, there were these actions:

• **As a minor concession to** the Administration, the Democratic leadership reduced its program from five to four years and the authorization by $110 million, from $575 million. In addition to the $100 million for the fifth year, the emergency allocation was cut from $75 million to $65 million. "During the next four years, we will be able to review what has been taking place," majority leader Sen. Lyndon Johnson (D.-Tex.) explained, "and then determine whether we wish to increase the program or decrease it. . . ."

• **An amendment** by Sen. Andrew Schoeppel (R.-Kans.) to continue the present program of $63 million in federal aid annually for the next four years—or a total $252 million authorization—was defeated 35 to 53.

• **An amendment authorizing** a total $308 million federal aid over four years offered by Sen. Thurston Morton (R.-Ky.) was voted down, 37 to 48. This provided $69.5 million a year, plus an emergency fund of $30 million. Morton said he had been informed by FAA Administrator Elwood P. Quesada that his proposal authorized "all that can be programed or obligated" and that "there is a reasonable chance" it would not be vetoed by the President.

• **Motion by Sen. Norris Cotton** (R.-N. H.) to ban federal aid for construction of terminal buildings was defeated 33 to 53.

Under the Senate-approved measure, 75% of the $465 million, or $305 million, would be allocated to the states and territories under a formula based on area and population. Allocations of over $10 million would go to California, $17.3 million; Illinois, $10.9 million; Michigan, $10.5 million; New York, $16.5 million; Pennsylvania, $12 million; Texas, $19.6 million. A total of $160 million would be allocated at the discretion of the FAA Administrator.

Canadair 540 Makes First Flight

Initial preproduction Canadair 540 turboprop transport makes its first flight at Montreal base of Canadair Ltd. Aircraft will be operated by Royal Canadian Air Force Air Transport Command (AW Feb. 2, p. 45); second preproduction 540, also for RCAF, is scheduled to make its first flight the first week in March. Third will be used by Canadair for demonstration and other purposes. First flight of 540, two weeks after rollout, lasted three hours; takeoff run, at gross weight of 48,834 lb., was less than 2,000 ft. Airframe is a new Convair 440 converted by Canadair for installation of Napier Eland turboprop engines. Royal Canadian Air Force has ordered 10.

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Initial Comet Operations Please BOAC

By Glenn Garrison

New York—British Overseas Airways Corp. says it has experienced "virtually trouble-free" operation of its de Havilland Comet 4 on the North Atlantic, where daily New York-London service was inaugurated Nov. 14.

Only one premature removal of a Rolls-Royce Avon turbojet engine has been necessary, occasioned by entry of a seagull which slightly damaged the inlet guide vanes. No other untoward incidents have occurred with the Comet, according to BOAC. Most delays on the transatlantic route have been due to weather, and most of the eastbound schedules have made it nonstop.

During the first two months of service, only five of 63 eastbound flights made stops, three at Gander and two at Shannon. Several of the nonstop flights, however, diverted to Prestwick, Gatwick and Hearn because of London Airport weather conditions. Flight times of the nonstops that landed at London averaged 6 hr. 55 min. from the beginning of service through Jan. 15.

Time between overhauls of the Comet's engines is now around 1,000 hr.

BOAC flies the Comet 4 as a de luxe and first class aircraft, and its load factor in both directions from Nov. 19 through Jan. 17 averaged 82%. This compares over-all with load factors of 62% for the airline's transatlantic Bristol Britannias during the same period, and 59% for its Douglas DC-7Cs.

The Comets, of course, are not true transatlantic airplanes and will move to other routes when BOAC gets its big Boeing 707-420s and, later, its Vickers VC-10s. Present aircraft seat 52 passengers, 32 in first class seats and 20 in de luxe accommodations. Configuration originally was 32 first and 16 de luxe, but BOAC added four de luxe seats by reducing seat pitch from 56 in. to 47 in. First class seats are pitched at 40 in. the additional seats represent potential revenue of $1¼ million a year.

Actually only 49 seats are currently sold on most of the Comet flights, with three seats normally being held in reserve for crew members in training. With the delivery of a Comet 4 simulator next month, most of these reserve seats can be released.

In terms of seat-mile operating costs, BOAC says its Comets are showing a 12.5% advantage over Boeing Stratocruisers which previously handled the "Monarch" first class schedules.

On the New York end of the run, the Comets perform a turnaround operation and normally never move more than about 100 ft. from their gate position while waiting on the ground between flights. After unloading, they are towed off the gate to a nearby hardstand parking area for servicing, and towed back again at departure time for loading. Only once has a Comet had to go to the hangar at Idlewild, that time for repair of a wing fuel tank leak.

Turnaround time at Idlewild, according to chief engineer Edward Steadman, is down to 11 man-hours, compared with about 13 man-hours for the DC-7C.

Anti-Noise Restrictions

Port of New York Authority anti-noise runway restrictions at the airport have had no effect on the Comet's payload or performance to date, although they could cause a flight to be delayed overnight. The Comet, with a full-load gross takeoff weight of about 157,630 lb., doesn't have the same runway length problem as the Boeing 707-120. But jet flights during nighttime hours must use the preferred runway, and if cross wind component ruled that runway out, the jet wouldn't be able to take off until morning. This hasn't happened so far with the Comet's 9 p.m. departures.

Comet 4's fuel requirement for a transatlantic eastbound nonstop is about 68,200 lb. on the average, BOAC says. On the route, it burns about 7,920 lb. of kerosene an hour at an average true airspeed of 410 kt.

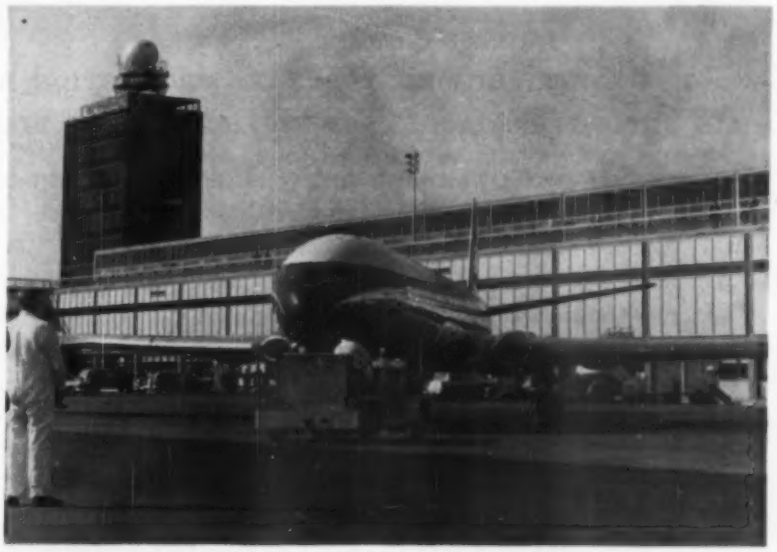
In flight planning its transatlantic Comet, BOAC is able to use a drift climb procedure most of the time, according to Andrew Murray, flight operations officer at Idlewild. On some occasions air traffic control limitations or military use of high-altitude airspace have precluded this technique, which is ideal for a jet. But generally the flights are planned with a beginning cruise altitude of 33,000 ft. and about 39,000 ft. as the final altitude of the cruise.

A flight planning problem for BOAC as a transatlantic jet operator has been in getting sufficient timely and accurate upper air wind and temperature data, but the airline says this situation has been improving.

In handling its Comet on the ramp, BOAC has established several precautionary procedures against blast effects. Captains must receive clearance from ground personnel before starting the engines, and they are regularly reminded to get their Comets rolling as easily as possible. The airline also carefully guards against equipment being left on the ramp behind the Comet's engines.

Only special ground equipment at Idlewild for the Comet is a 28 v.a.c., 112 v.d.c. power unit. The airplane's engines are started electrically, and can be turned over by the aircraft's battery if no external source is available. BOAC has three of the power units at Idlewild, one in a truck on the ramp and the other two in the hangar. The two Mercury tugs used for handling BOAC's other aircraft at the field are sufficiently powerful to haul the Comet's weight.

Steadman says he has experienced almost no bugs of any kind with the Comets, whereas both the DC-7C and Britannia are delayed by mechanical



BOAC de Havilland Comet 4 turns around at N. Y. International Airport after transatlantic flight. Jet transport is towed from gate to nearby parking area between flights.

The A.W. ARGOSY Takes the Air

HAWKER SIDDELEY BREAKS PRODUCTION RECORDS WITH NEW AIR FREIGHTERCOACH, FROM "GO AHEAD" TO FIRST FLIGHT IN 28 MONTHS

The Armstrong Whitworth Argosy is the world's first pressurised turboprop freighter-coach. Never before in Britain has such a large and complex aircraft made its first flight so soon after the decision to go ahead —only 28 months. This is further proof of Hawker Siddeley's unrivalled reputation in the British aircraft industry, not only for high quality craftsmanship, but ability to meet and beat production schedules. The Argosy ushers in a new era of "flying without frills". It offers 300 m.p.h. economical air transport for freight and coach-class passengers. With its capacity for 13½ short tons, full-width doors and quick-loading system, it reduces turn-around time and freight rates to a minimum. The Argosy can be in service on the world's air routes by 1960.

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THE ***Argosy*** ... BRINGS THE COST OF AIR FREIGHT DOWN TO EARTH

troubles, particularly of a systems nature. BOAC has recently intensified a campaign to eliminate faults in the Britannia which, according to the airline's house organ, "have given the medium and long range Britannia a bad name for punctuality." Among the problems, which have caused more than 500 modifications by BOAC alone on each of its 15 Britannia 102s and 90 modifications of each of its 18 Britannia 312s, have been fuel, electrical and hydraulic systems, BOAC said.

BOAC started its scheduled transatlantic Comet service on Oct. 4., but this was a more or less token once-a-week schedule to win a first on the run ahead of Pan American World Airways. It was quickly interrupted by a strike at London Airport and service was not resumed until the daily operation. The airline also flies a weekly Comet schedule to Montreal.

The airline now has six Comet 4s. Deliveries will be halted for a couple of months while de Havilland supplies Aerolineas Argentinas with half its order of six, and then resumed until BOAC has received its full order of 19 sometime this year.

Comet service to Tokyo, to tie in with a new BOAC Pacific Britannia service, will be inaugurated probably late next month with some of the six-plane jet fleet. The Far Eastern service will involve four weekly Comet schedules. South and Central African services with the jet are planned beginning in mid-December, 1959, Australian services in mid-November, 1959; and South American services in mid-January, 1960.

First of BOAC's Boeing 707-420s is expected to be delivered late this year and the remaining 14 in 1960. Comet 4s then will be phased off the North Atlantic and onto the other routes.

The sole unscheduled engine change in BOAC's transatlantic Comet operation, involving a seagull, followed a normal crossing during which the captain was not aware that anything had gone into the engine.

Performance of the engine appeared normal, and the damage was discovered on the ground.

Boeing Opens 707 Spare Parts Facility

New York—Boeing Airplane Co. has opened a spare parts pool store at New York International Airport for its 707 jet aircraft and ground starter turbine customers. The New York facility is linked by teletype with Boeing's parts store at Renton, Wash., and inventory control for both will be handled by RAMAC computer at Renton.

A third store is scheduled to be opened in Paris next summer to handle "insurance" items for jet operators.

The Same Old Story

The lack of visual aids continues to extract its toll from aviation. This is doubly vexing to this author because of the amount of space devoted by this column and elsewhere to airport lighting over the years and because a good friend, American Airlines' Capt. Al DeWitt, lost his life in the first crash of a Lockheed Electra. On the evidence at this writing I am content to state that proper visual aids would have prevented this accident.

Quite likely the cause of this accident, at some later date, will be officially described as "pilot error." Investigators historically have lacked the courage to point out that this "error" lies not in the pilot but in the visual indications given to him.

It is indeed ironic to note that some 11 years ago the person most interested in obtaining better lighting for LaGuardia's runways and who, in April 1948, test flew the then-new condenser discharge lights at LaGuardia Field was Al DeWitt.

What can be said, that 65 more bodies do not say, to emphasize the need for lighting? What can be done to shake the Federal Aviation Agency people into taking firm action? How can we tell "Pete" Quesada that we don't need another research program, that we don't need more drones in the lamp department, that we do need a man of high caliber, who understands the operation of aircraft, to put a stop to the nonsense in the field of visual aids. The eternal factors of incompetence and obstructionism are rearing their heads in the FAA approach to airport lighting just as they always did in the past at the CAA. There has never been an intelligent aviation agency plan for visual aids, most likely because there has never been a properly qualified person in a position of authority to handle such an assignment.

What Should Be Done

Such a program is simplicity itself. Every instrument runway should include a Cutrell approach light system. At locations where the full 3,000 ft. is not possible, a shortened configuration should be used. If no approach lights can be installed—and I can't quite figure out where this might be—then the standard threshold lighting should be enhanced with two condenser discharge lights, one at each corner of the runway.

Studies in human perception are not new. And many people have investigated the visual clues needed by the landing pilot. The sum of this work indicates that the human eye depends upon a rectangle for orientation. That is, the pilot must not only have an indication of the horizon but also a line at right angles to this to provide some perspective. The rectangle of a runway, for instance, furnishes the needed information. The extent to which the sides of the runway converge toward the "vanishing point" gives the pilot his indication of height.

In today's aircraft a pilot making an instrument approach has only seconds to decipher the visual clues presented to him prior to landing. If his first glimpse of the ground presents an erroneous picture, he may take action which will compound his error. From that point on, the behavior of the outside world will be incomprehensible to him. Nor do we need bad weather for this. Aircraft have crashed while circling Pacific islands under starry skies. But pilots are still expected to operate without required human visual information.

It boils down to this. A "backside" approach such as Al DeWitt was making means that you place almost complete dependence upon some small accordion bellows—the altimeter. Lacking visual aids there is no way to confirm or deny its reading. Will "Pete" Quesada rise to the occasion and find a suitable "strong man" to clean up this visual aid situation? Or will we continue to see the use of kamikaze tactics to obtain better facilities for our "backside" airports?

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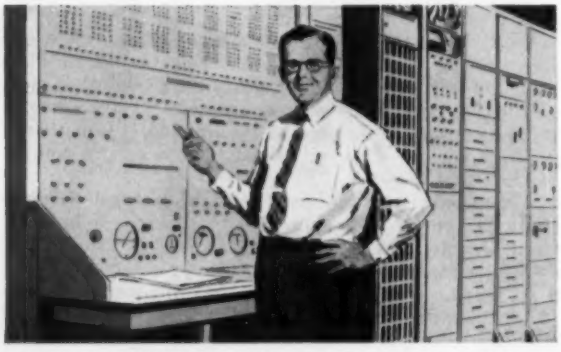

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WESTERN AIRLINES

SHORTLINES

▶ **Airwork and Hunting Clan,** British operators, have applied for permission to slash fares for flights to British overseas territories. The proposals are almost identical to those submitted by Eagle Aviation last December which would create a new class of traffic. British Overseas Airways Corp. and British European Airways have lodged objections to Eagle's application, charging the fare cuts would interfere with their tourist operations. Only holders of British passports would benefit from the new fares.

▶ **Civil Aeronautics Board** has found present free baggage allowances for scheduled airline operations to be fair and reasonable. The Board initiated an investigation of baggage allowances and excess baggage charges in April, 1956, and has now ordered the investigation terminated.

▶ **Continental Airlines** registered a net loss of $338,280 for the year ending Dec. 31 as compared with a net profit of $96,073 in 1957. The 1958 loss appeared despite company records for all types of traffic—422,964,000 revenue passenger miles, up 16.3% from 1957; 1,969,000 freight ton miles, up 26.1%; 1,207,000 mail ton miles, up 11.4%, and 543,000 express ton miles, up 18.6%. Continental has signed an interline agreement with Transcontinental, S. A. to honor each other's passenger tickets and cargo waybills. Loss was attributed primarily to "higher depreciation and interest charges resulting from the company's transition to turbine powered aircraft."

▶ **Iberia Airlines of Spain** will offer three nonstop New York-Madrid flights weekly and one New York-Lisbon-Madrid flight weekly in its 1959 summer schedules. Returning schedules will follow the same pattern. All flights will be in Lockheed 1049-G Constellations in first, tourist and economy classes.

▶ **Pan American World Airways** is scheduling twice daily Boeing 707 turbojet flights to London, 11 jet flights weekly to Paris and daily flights continuing from Paris beginning April 26. In addition, four weekly flights to Paris will be routed via Boston, making that city the second U. S. international jet gateway. PanAm will operate all its 707 services on a de luxe and economy basis and first class and economy basis on piston-engined aircraft on the summer schedules, eliminating tourist class on transatlantic routes.

AIRLINE OBSERVER

▶ Watch for British to decide next month to go with development of a supersonic jet transport. Probable choice of the Supersonic Transport Aircraft Committee, established three years ago to study the project, will be a Mach 2.5-3 canard, delta-wing configuration similar to that proposed by Handley-Page. The committee, however, is reportedly sharply divided on whether to stay with current alloys at a Mach limit of about Mach 1.8 or go to the more radical aircraft.

▶ **Expansion of airline sales programs to encompass marketing techniques will result in the introduction of a number of new traffic generating schemes this year. One of the first to make its appearance will be a Capital Airlines program designed to sell package vacation tours to employes of large industries and companies on a wage deduction plan.**

▶ Look for New York Airways to show renewed interest in the Fairey Rotodyne VTOL transport. Under serious consideration is a proposed 65-passenger model powered with Rolls-Royce Tyne engines. Rotodyne is currently flying a 45-passenger test vehicle equipped with Napier Eland engines.

▶ **Federal Aviation Agency plans to remove all air traffic controller training activities from active control towers and control centers by streamlining training curricula and making full use of facilities at its Oklahoma City training center.**

▶ Nine members of the Arab League and the Sheikdom of Kuwait will meet in Cairo next month to discuss formation of a Pan-Arab airline with capital raised entirely by the Arab governments and individuals.

▶ **Air France will inaugurate Sud Caravelle turbojet transport service between Paris and Rome and Athens and Istanbul on May 15. The carrier also plans twice-weekly service from Paris to Moscow via Warsaw when authority to make the intermediate stop is granted by the Polish government.**

▶ Research and Development Bureau of the Federal Aviation Agency has ordered a RW-300 Digital Control Computer with special input and output equipment from Thompson Ramo Wooldridge for use in developing airways control systems.

▶ **British Overseas Airways Corp. is considering plans for a polar route from London to the U. S. midwest, via Frobisher and Winnipeg. Scandinavian Air Lines System now has a Winnipeg stop for crew change and refueling, but has been denied traffic rights by Canadian government.**

▶ Italy and United Arab Republic have reached a preliminary agreement on their bilateral air transport pact. Way is now paved for Alitalia to develop new routes to the Far East and for Misrair to expand in Europe through the Italian gateway.

▶ **New jet fuel jointly developed by the Texas Co. and Pratt & Whitney Aircraft Division of United Aircraft Corp. shows promise of virtually eliminating exhaust smoke on takeoff and increasing engine performance. Compared to present jet fuels, the new material is believed to have significantly lower content dinuclear aromatic hydrocarbons and, therefore, airlines speculate that it will burn with a less luminous (bluer) and cooler flame. This could enable the engine to burn more fuel, heat more air and produce more thrust without becoming overheated. Fuel will be flight tested in about three weeks.**

▶ Northeast Airlines has been taken off subsidy by the Civil Aeronautics Board, effective Jan. 1. The Board issued the statement in Northeast's final mail rate case in which the carrier was granted $4 million for the period from Feb. 7, 1957 to Dec. 31, 1958.

▶ **Polish LOT airline has opened its 13th air route, from Warsaw via Vienna to Zurich on a twice-a-week basis until April 1, when a third weekly flight will be added. Also in April, Hungary's MALEV airline will start a route from Budapest to Zurich, via Vienna.**

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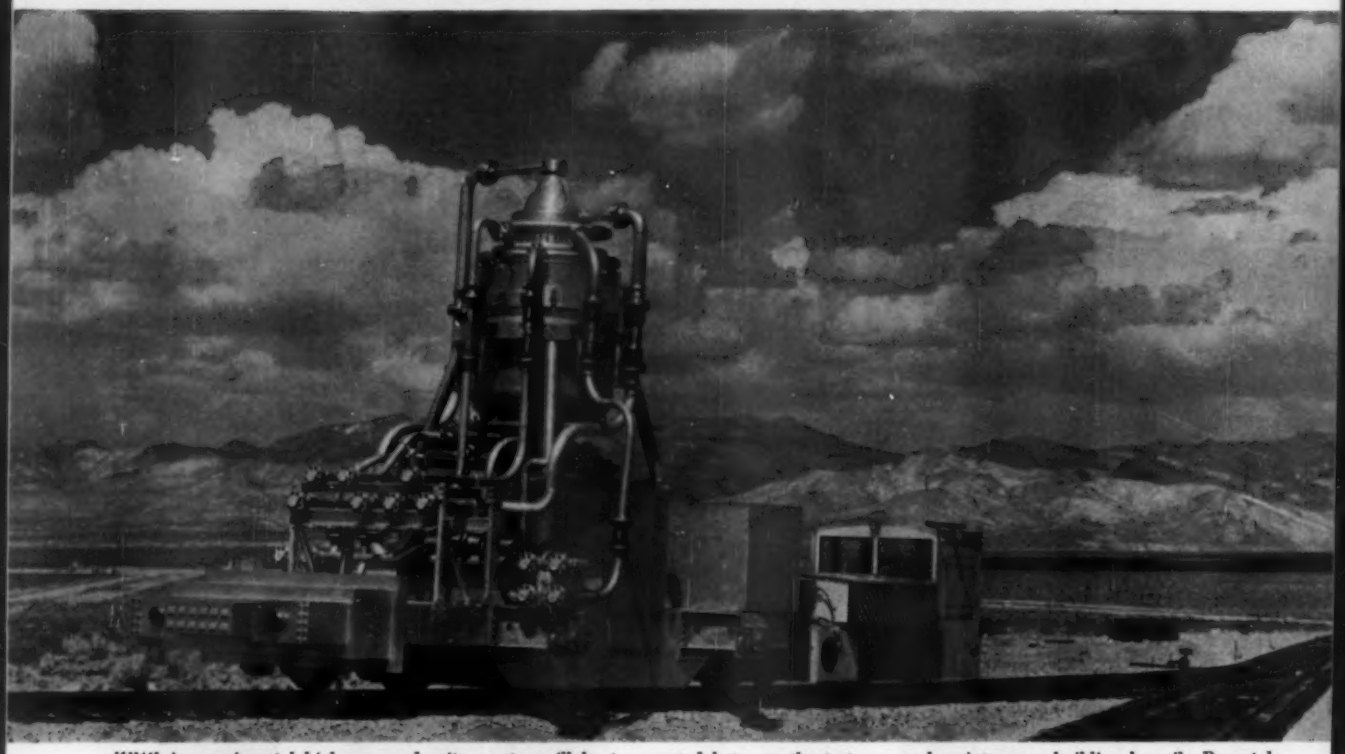


KIWI-A experimental high power density reactor will be transported between the test area and maintenance building by rail. Remotely controlled engine will be used after actual tests. Helium will be employed as propellant-coolant during first hot tests and will be exhausted upward. Nozzle on this first test setup is not of the supersonic type and is intended to create proper back pressure.

Kiwi-A to Test Nuclear Rocket Feasibility

By J. S. Butz, Jr.

Washington—United States effort to determine whether a nuclear rocket engine is feasible under present knowledge will move significantly closer to a definite answer this spring when initial hot tests are begun with Kiwi-A, the first experimental reactor approaching the type needed in a flyable rocket.

Cold flow tests with Kiwi-A probably will begin sometime in February although they were scheduled last fall. Delays in the test schedule have been largely connected with the construction and initial operation of the new test facility for Project Rover, the nuclear rocket program which is located at Jackass Flats, Nev. (AW Oct. 13, p. 33). The reactor itself is essentially ready for the cold flow tests.

Kiwi-A which has a high power density compared with other reactors today, is a vital link in the Atomic Energy Commission project, initiated in 1955 to prove the feasibility of a fission-powered rocket. At that time Atomic Energy Commission theoreticians concluded that they could not improve the case for the nuclear rocket any further without substantial testing. Project Rover was then formed with the backing of the Department of Defense to consolidate the rocket work then taking place at the Atomic Energy Commission Los Alamos and Livermore laboratories. It was then planned that the feasibility would be established by 1959 through ground tests with more than one complete nuclear rocket engine.

Date Moved Back

This 1959 feasibility date has been moved back for two main reasons. First, the AEC decided as the program progressed that it had been too optimistic and when one laboratory group was taken out of the rocket work to participate in weapon development the date was considered to be extended by one year. Second, the early enthusiasm of the Department of Defense also changed after a study of the program in the summer of 1956 by the Department's Loper Committee. While the Loper Committee recommended a prompt effort to demonstrate the feasibility of such a reactor, Charles E. Wilson, then Secretary of Defense, sent the report on to the Atomic Energy Commission with a covering letter containing the following statement, "At my specific request can the AEC continue on a moderate scale to develop a reactor suitable for nuclear propulsion of missiles, satellites and the like."

The feasibility date on the present Project Rover development schedule has not been released but judging from the time required on the first schedule and the low level of funding existing for the project, feasibility will not be proven conclusively for perhaps two years after the Kiwi-A hot tests begin. Full-power tests on at least one other reactor with a higher power density than Kiwi-A will be required before feasibility of the nuclear rocket is established. According to one of the schedules mentioned before Congress, this second reactor would be ready for testing late in 1960. Design work has begun on still other test reactors.

Feasibility will not be considered to have been proven until the detailed information is at hand to design and construct a flyable engine. An understand-

ing of the sense the Atomic Energy Commission attaches to the term "feasibility" as applied to the nuclear rocket was given recently by Dr. Raemer E. Schreiber, technical head of Project Rover. He said, "There is not much point in such a development (Project Rover) unless it offers something appreciably more advanced in performance than the really excellent rocket engines that are propelling missiles today."

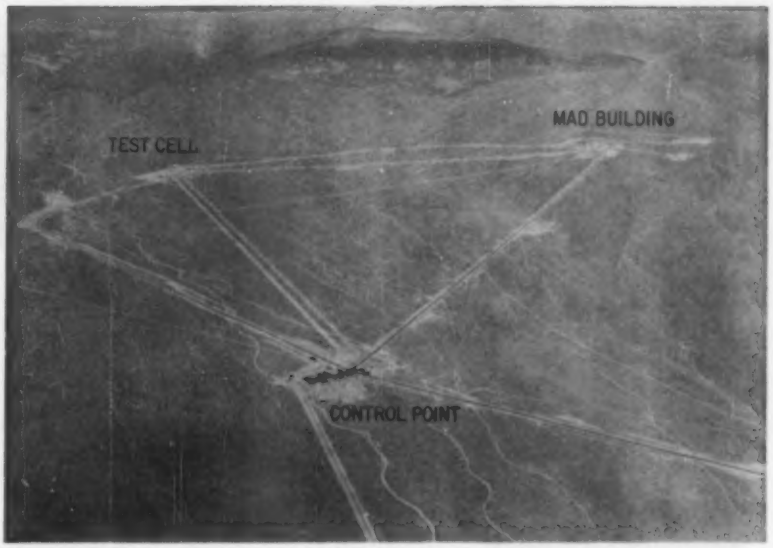
Specific Impulse

Exact value of specific impulse for the nuclear rocket that the Atomic Energy Commission would consider acceptable has not been made completely clear but 750 sec. has been mentioned by Schreiber as necessary to build a single stage vehicle which can escape from the earth carrying about 15% of its takeoff weight as payload.

A single stage nuclear-powered space exploration vehicle has been discussed by many authorities as the only way out of today's reliability problem. They say that multistage rockets with clustered engines and the large number of attendant controls and auxiliary systems will be too expensive to bring the reliability level necessary for prolonged space flight.

Money invested in Project Rover has not been large by current standards and it is in no way a crash program. This fiscal year $15 million was allotted for operating the project and $12.5 million assigned for construction of new facilities. The Rover budget in Fiscal 1960 will be essentially the same unless changes are made by Congress. Expenditures during the project's first year or so were below the present level.

According to congressional testimony by Project officials, an increase in appropriations would probably not result in any substantial shortening of the time needed to prove feasibility. More money could be used however, to buy insurance for the whole program by allowing more than one experimental path to be followed. If a number of the most likely looking heat exchanger reactor designs could be pursued at once it would greatly reduce the lost time incurred in the event of complete failure of the Kiwi-A approach.



TEST complex for Project Rover at Jackass Flats, Nev., designated "400 area," consists of the three main areas shown above. Distance between each area is approximately two miles. Test work as well as design on Project Rover is handled by the Atomic Energy Commission's Los Alamos Scientific Laboratory. Installations in "400 area" are large; the "MAD" (Maintenance-Assembly and Disassembly) bldg. has 30,000 sq. ft. of floor space.

Two principal directions are being followed in Project Rover:

- **Development of systems** employing heat exchangers which replace the combustion chamber of the rocket engine.
- **Study of systems** which do not have the structural and temperature limitations of heat exchangers and make use of a much larger percentage of the available nuclear power.

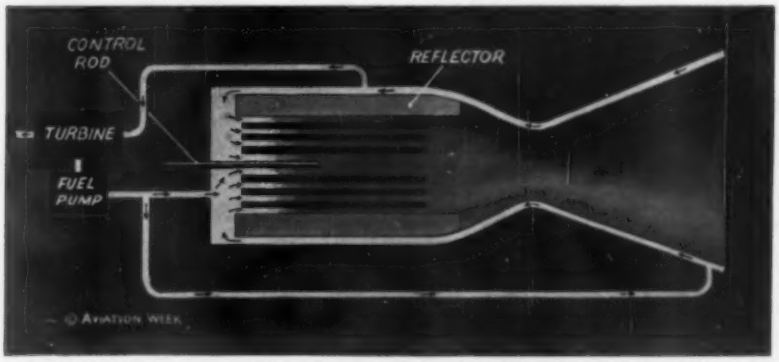
Propulsion schemes in the second category of work which have been mentioned include mixing gaseous or powdered fissionable fuel directly with the propellant. The expense of exhausting this costly fuel plus the radiation hazards and many other problems are keeping this work primarily in the theoretical stage, Ion and plasma propulsion systems are included in this category.

Major hardware and testing effort in Project Rover is devoted to the heat exchanger type reactors. To support this work the project is also engaged in general high temperature research, development of nuclear fuels, studies of heat transfer mechanisms, fluid dynamics and reactor controls.

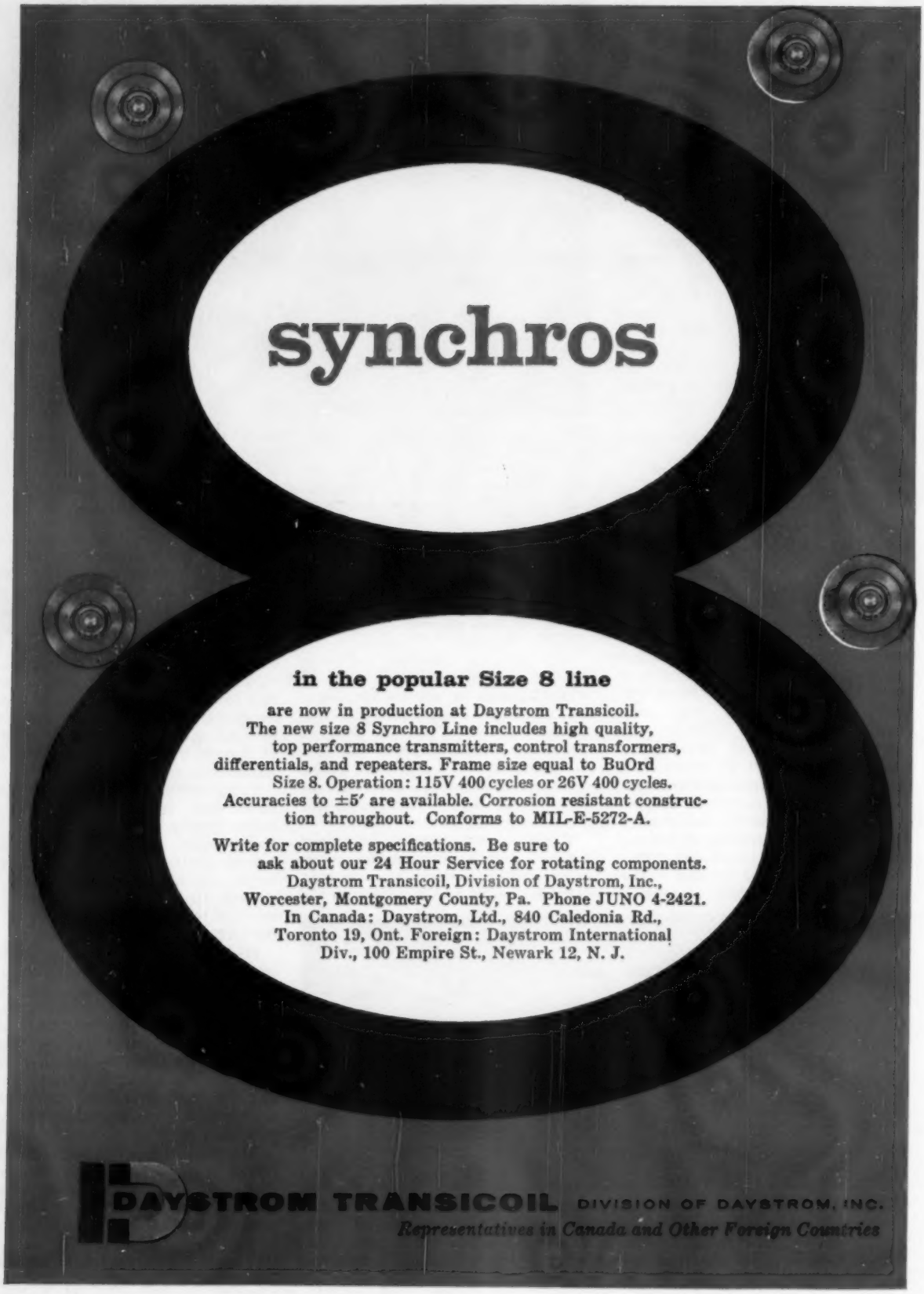
Generally the design problems associated with Kiwi-A and other high power density reactors have been described by Dr. Schreiber as more difficult than those connected with previous reactors. High power density is needed so that the reactor weight can be kept low and the total weight of the rocket remains within reason.

Heat fluxes and thermal stress become more serious as the power density goes up. Control problems are also more serious with the nuclear rocket because there are three interdependent variables which must be regulated, rather than two in the chemical fuel rocket. In the chemical engine, pressure and flow rate control thrust. But in the nuclear rocket it is dependent on temperature as well.

The propellant is the coolant for the reactor as well as the medium for producing thrust. If the cold propellant flow is not closely coordinated with the power level of the reactor it is possible to burn up the engine in a few seconds. The reactor in the nuclear rocket must be capable of starting very rapidly and



SCHEMATIC drawing of a solid fuel type atomic rocket engine shows fissionable material contained in a heat exchanger which replaces combustion chamber on chemical rockets. Control problem is more complicated with the atomic rocket because flow rate, pressure and exhaust temperature are interdependent and must be properly balanced; in liquid fuel chemical rocket only pressure and flow rate need be regulated.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changing power level quickly. Considerable control automation will be required to meet this starting and quick power change requirement.

Dr. Schreiber, in discussing the problems of high power density reactors, said, "All of these things look rather difficult and I would not pretend that they are not. On the other hand, they do not seem to be impossible."

The short operating time of the rocket reactor is about the one factor that appears to make the design job easier than on other reactors. Dr. Schreiber discussed this and the radiation contamination problems before Congress: "When the propellant quits in the flying device this thing will burn itself up from self-heat. If it isn't completely consumed by that, when it hits the atmosphere, it will act like a meteorite and disperse itself there. This is true unless the device gets into space which is an easy way of solving your problem. If you are talking about a satellite or an earth mission, then it is true that you will have this contamination added to the atmosphere but even for one of these larger devices . . . you are talking about never more than five kilotons of equivalent fissionable yield which again is a trivial amount compared with everything that goes on in weapons testing."

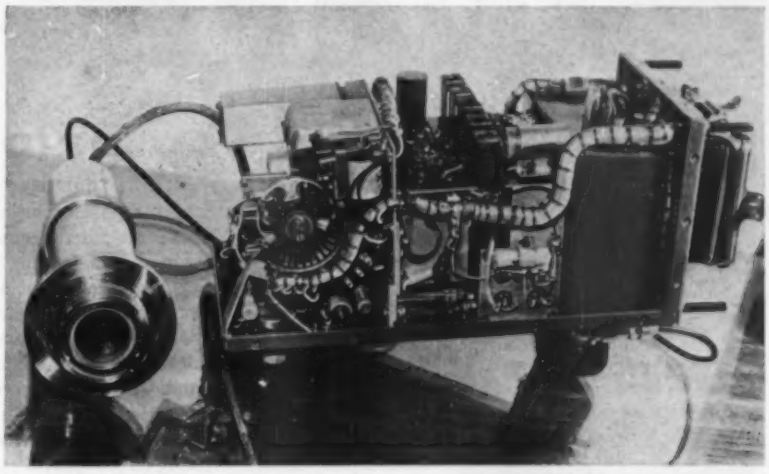
Site Contamination

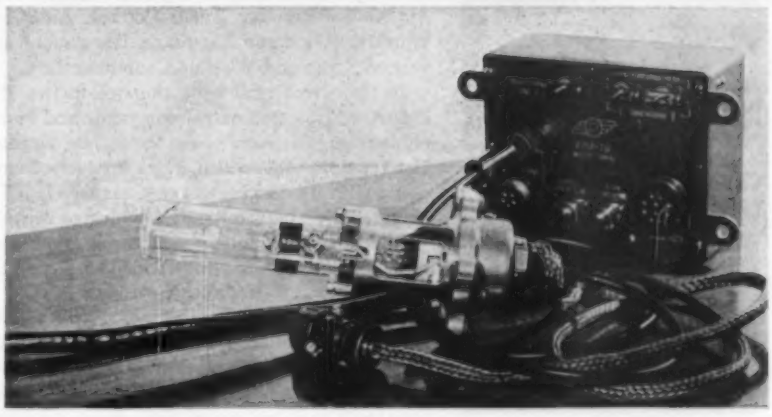
Dr. Schreiber also talked about the contamination problem around the launching site: "I think it is perfectly true that one will have to put this (nuclear rocket) on a launching pad which you do not expect to use again for several months. I think, however, these can be located on centers that are not more than half a mile apart, but you do have a problem of remote firing and of having a local contamination at the time of launching."

Design of Kiwi-A began with a series of detailed experiments designed to provide more realistic quantitative data than had been available during the original theoretical studies. Neutronic experiments were performed to determine the proper distribution of fissionable material in the fuel elements so that a uniform temperature would be maintained in the reactor under low power conditions. Heat transfer efficiency of the radiator-like reactor, its deformation at high temperature, and the strength of its fuel elements and construction materials under thermal loads are very important factors in these studies. Approximately 20 different critical assemblies were tested before the Kiwi-A configuration was made final.

These early tests were all made at relatively low power as was a test of Kiwi-A itself to check its neutronic behavior. A number of questions, however, cannot be answered unless the complete reactor is operated at high temperature. The first benefit which will be derived from the hot, high-power runs with Kiwi-A at Jackass Flats will be to determine the temperature coefficient of reactivity. Theoretical and low power studies leave an uncertainty about this figure over a considerable portion of the operating range. Another somewhat unknown quantity is the temperature gradient in the reactor which are a function of rate of start up, length of run and variables which cannot be properly represented except through high power tests.

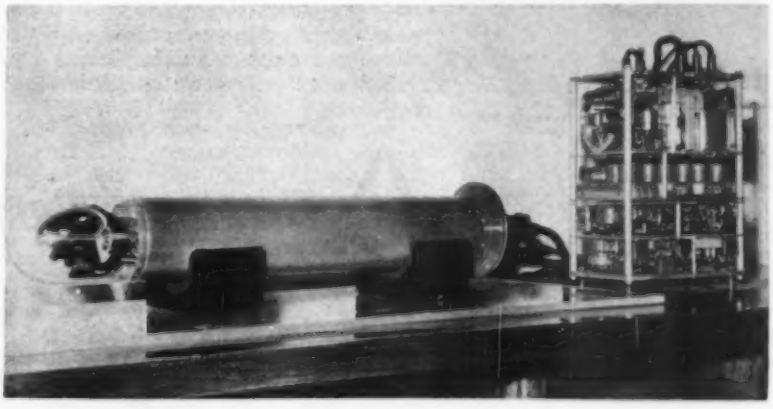
A good deal of information has





Sputnik III Instrumentation

Sputnik III mass spectrometer tube with associated electronic unit (top), ionization manometer and d.c. amplifier (center), and nose magnetometer with electronic unit (bottom) are shown in greater detail than previous photographs (AW Dec. 15, p. 48). Magnetometer measures terrestrial magnetic field and magnetic interference vector in direction of earth's magnetic field.



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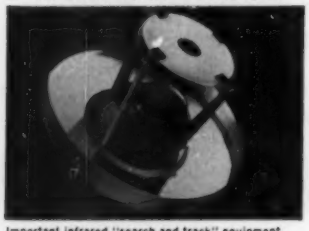

Important infrared "search and track" equipment is now being developed by Ramo-Wooldridge for applications in modern U.S. Military aircraft

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New type of radar data processing system developed by R-W materially increases the capabilities of ground defense radar

While it is now a division of **Thompson Ramo Wooldridge Inc.** instead of a separate corporation, **Ramo-Wooldridge** remains an integrated organization for research, development, and manufacture of electronic systems for military and commercial applications. R-W's military work is covered by thirty-four contracts with the Army, Navy, Air Force, and other government and industrial organizations. These support a broad technical and—in some cases—manufacturing program in such varied fields as Electronic Reconnaissance and Countermeasures; Microwave Techniques; Infrared; Analog and Digital Computers; Air Navigation and Traffic Control; Antisubmarine Warfare; Electronic Language Translation; and advanced Radio and Wireline Communication.

In the commercial field, the well-known RW-300 industrial process control computer and associated equipment—the basis of the expanding business that **The Thompson-Ramo-Wooldridge Products Company** is doing with process industries—was developed and is manufactured by the Ramo-Wooldridge division.

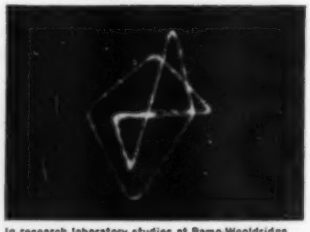
Men, machines, and manufacturing know-how from other TRW divisions will be added as needed to build up the growing production strength of the Ramo-Wooldridge division. In other ways, too, the availability of the special skills and facilities of the rest of the corporate family will broaden the services R-W can offer to its customers. However, R-W's major systems work will continue to be done in an organizational framework that brings the engineering and manufacturing groups into close-knit project teams in the division's own integrated development and manufacturing facilities in both Los Angeles and Denver.

Ramo-Wooldridge is production-oriented in the sense that its end objective is the manufacture and sale of equipment. However, because of the highly technical nature of its product lines, the R-W division will continue to give unusual emphasis to maintaining a high degree of professional scientific and engineering competence.

The RW-300 digital control computer has broad applications in automatic process control, data reduction and test facility operation

Systems are being developed for the ground processing and interpretation of photographic and other data collected by aerial reconnaissance devices

The Military and Ramo-Wooldridge are studying the use of automatic data processing techniques



In research laboratory studies at Ramo-Wooldridge, electrically-charged particles are contained and supported in a vacuum by an alternating electric field

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already been developed in Project Rover concerning high power density reactors that has revised previous theory. According to Dr. Schreiber, the Kiwi-A fuel volume was drastically increased in going from the idealized form to the final design.

Such information developed during this high power density work is expected to benefit all reactor technology by supplying data closer to the theoretical operating limits of fission systems.

Coolant Gas

Early heat transfer test work in Project Rover has been accomplished with a collection of used submarine batteries capable of delivering 10 megawatts to the busbar to heat sample portions of a simulated reactor assembly through which coolant gas was circulated at known rates. It is indicative of the success of this work that Dr. Schreiber has said, ". . . if we are clever enough about the heat transfer, the gas can be ejected essentially at the temperature of the fuel element of the reactor."

Test facilities at Jackass Flats which have been especially constructed to handle high power experiment with nuclear rockets are divided into three main areas: the test cell, the control building, and the maintenance-assembly and disassembly building. These areas are arranged in a triangle with each located about two miles from the others. A railroad has been constructed between the maintenance building and the test cell and a remotely controlled engine is available to transport the experimental reactor between the two points. The remote controlled railroad is necessary because the radiation level will make it impossible to approach Kiwi-A and the reactors that follow it after even moderate power tests. The reactors will be taken to the maintenance building where they are placed in a heavily shielded chamber and are adjusted and repaired through the use of remote-control manipulators.

Shielded Building

Test instrumentation and other equipment necessary at the test cell are placed within a shielded building at that site. It is possible to enter this building through a tunnel and service the apparatus after a test has been completed, but not while the reactor is operating.

While radiation contamination is high in the immediate area around the test cell and the maintenance building, it is described by the Atomic Energy Commission as a local problem. Dr. Schreiber has said that if the reactor were to melt or explode, the fissionable fragments that might result would make a trivial contribution to the radiation level of the atmosphere. The total

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EACH SWITCH HAS "OFF" POSITION PLUS NUMBER OF POINTS LISTED.

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3	2"	1153	36SR3
4	2"	1154	36SR4
5	3"	1055	37SR5
6	3"	1056	37SR6
8	3"	1058	37SR8
9	3"	1059	37SR9
10	3"	10S10	37SR10
12	3"	10S12	37SR12
16	3"	10S16	37SR16
18	3"	10S18	37SR18
20	3"	10S20	37SR20
24	4"	2752482	38SR24
28	4"	2752884	38SR28
40	4"	38S2C	

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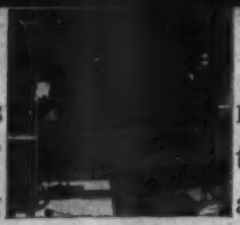

ENGINEERS...FOR IDEAL WORKING CONDITIONS WITH A DYNAMIC, CREATIVE ORGANIZATION, ADDRESS RESUME TO CHIEF ENGINEER

HALLAMORE

Space Vehicle Power Source

Thermionic converter which produces electric power when excited by a radioactive isotope, making it a possible power source for space vehicle use, has been successfully operated for eight days by General Electric Co. Larger capacity device, capable of producing 100 watts power for more than a year, would weigh less than 25 lb., General Electric estimates. Unlike the recently announced SNAP III thermoelectric power source (AW Jan. 26, p. 35), which generates electricity in the manner of a thermocouple, a thermionic converter boils electrons off a hot metal plate, similar to a vacuum tube, which travel to a cooler plate, producing current flow.

power of the Kiwi-A reactor is a small fraction of a kiloton which is not large in comparison with the power of some of the nuclear weapons exploded in the United States.

First tests with the Kiwi-A reactor will be conducted using helium gas as the propellant-coolant. Later tests are scheduled with hydrogen gas serving this purpose. Judging from some of the technical papers which have been delivered on the subject of nuclear rocket test stands, it would appear that the hydrogen tests would require some alteration to the Jackass Flats site or would have to take place at another facility.

Fire Danger

A study by S. G. Runbold, L. H. Taylor and L. E. White of Aerojet-General Corp. lists the danger of explosion and fire as the primary reason for a more elaborate test stand when using hydrogen propellant. Hydrogen that has been expelled from the rocket tends to form a combustible mixture with the surrounding air. It is considered possible for the test engine to be subject to the hazards of flame or hot gas during all or part of the test. Provisions would therefore have to be made to dissipate this collection of gas or to duct it away and burn it at some place remote from the operating rocket. If such provisions have already been made at the Jackass Flats test area they have not been shown or discussed to date.

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he's a DELAVAN FUEL INJECTOR SPECIALIST

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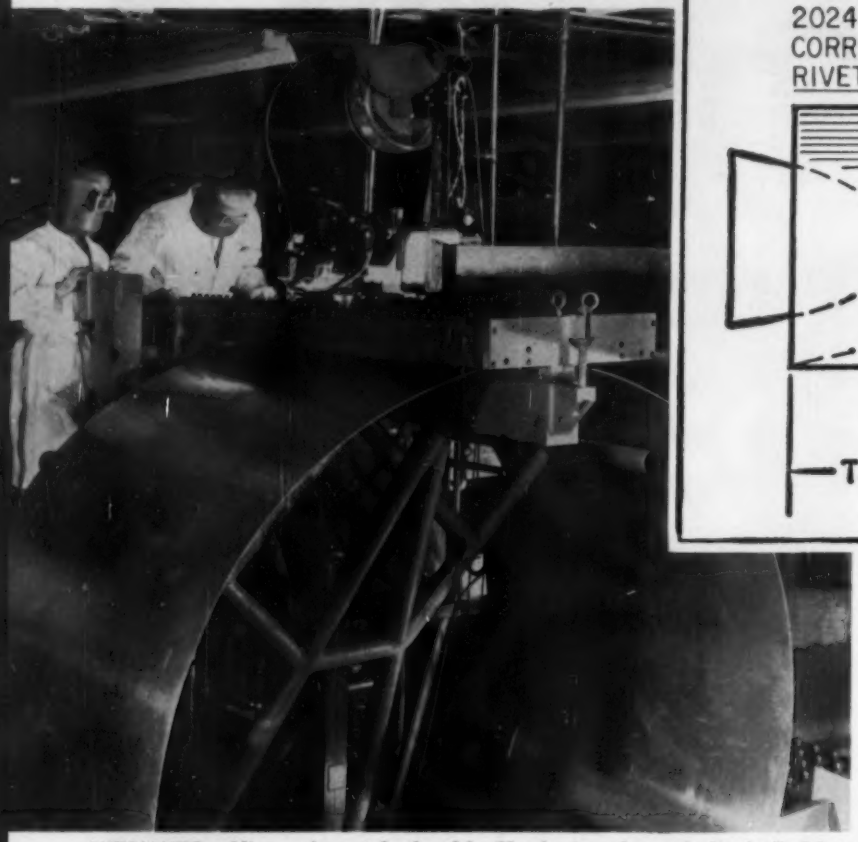
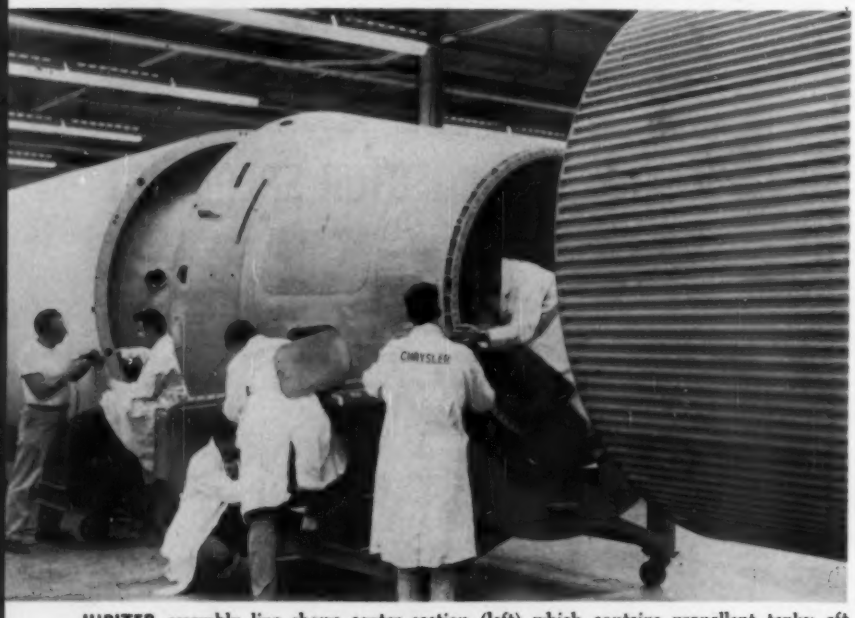
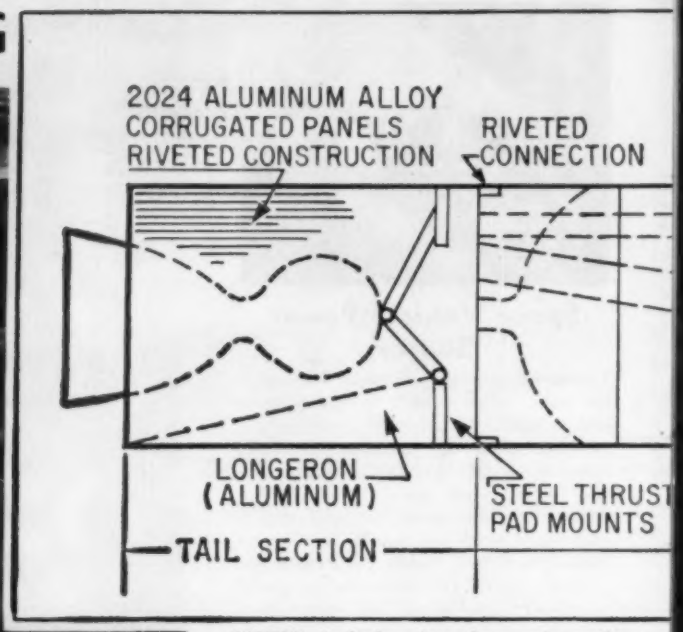


AUTOMATIC welding equipment developed by Chrysler is used to make longitudinal butt weld, forming one of seven center section skins. Butt welds are X-rayed 100%.



JUPITER assembly line shows center section (left) which contains propellant tanks; aft section (center) which contains instruments; and corrugated tail assembly (right).



JUPITER is broken into four main sections:

How Chrysler

By Evert Clark

Detroit—Chrysler Corp. has produced the Army Jupiter intermediate range ballistic missile in what it calls a "record minimum lead time of three years," and has given the missile a reliability that the Army sets at 92%.

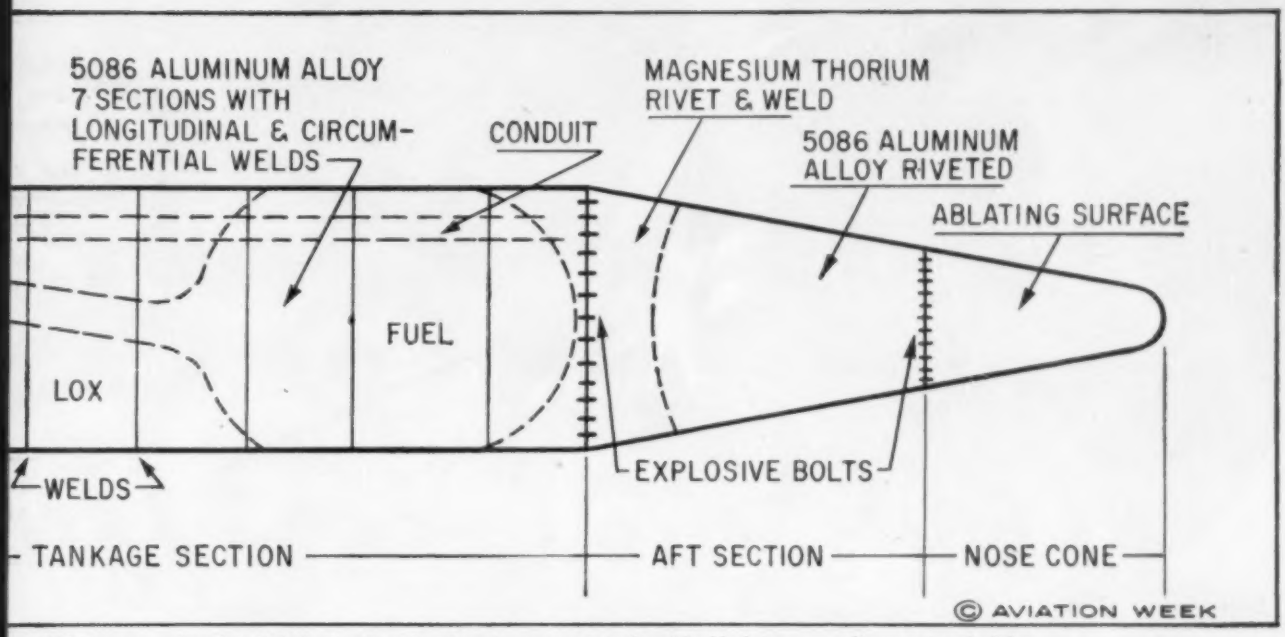
This lead time included many months when Jupiter shared an off-again, on-again status with the USAF-Douglas Thor before both were finally ordered into production for Air Force deployment.

Time from the first order to produce complete Jupiters until the successful firing of the first Chrysler-produced missile last month was just over a year, although the company had been building major components for Army Ballistic Missile Agency's use for several months before the production order came.

In spite of Chrysler's long experience with automotive and defense production and its background of Redstone missile production, Jupiter required not only new production tooling and techniques, but considerable development of both machinery and methods.

Contrary to the widely held impression that Jupiter research and development was handled almost solely by the Army, with Chrysler coming in only at the production stage, the company has been in the Jupiter program from its inception.

Although a number of Jupiters have



Missiles are produced in "blocks," and engineering changes are introduced by block to assure adherence to schedules.

Programs Production of Jupiter IRBM

been completely assembled at ABMA in Huntsville, Ala., the company and the agency worked very closely in developing the techniques used there.

Because of the major role that Chrysler engineers played in planning and developing the Jupiter, it has in one sense been "production engineered" from the beginning.

But the knowledge gained in the Redstone and Jupiter development programs gave Chrysler a strong appreciation of the importance of constant change.

John S. Sheldon, production manager of Chrysler's Missile Division, says that integration of engineering, quality control and manufacturing personnel is conducted on a daily basis, "and has been developed to a higher degree than is prevalent in other well-known industries."

Chrysler has some firm ideas on the contribution that its experience in automotive production has made to missile work.

Thomas F. Morrow, group vice president for defense and special products, says that the same fundamentals of production management carry over directly —planning, scheduling, cost and quality control.

"Vast experience in efficient processing and tooling, integrated production and assembly operations, effective procurement and management of inventories also contribute substantially," Morrow said.

Jupiter is produced in the 2.1 million sq. ft. Michigan Ordnance Missile Plant in Sterling Township, 20 mi. northeast of here, alongside the 200-mi. range Redstone and the support vehicles for both systems.

Although there are no conveyor-belt assembly lines, assembly line methods are used. A number of missiles of the same design and bill of material are programed under a "block system," and engineering changes are introduced by block, to assure adherence to certain schedules, cost control and reliability.

Jupiter structure is broken into four main sections: tail assembly, center section assembly, aft section assembly and nose assembly.

Tail assembly consists of an outer skin of 2024 aluminum alloy panels approximately 12 ft. long corrugated for strength and stiffened by 10 aluminum Z-ring frames, two aluminum longerons, aluminum compression struts and an aluminum lateral panel. All construction is riveted. Thrust pad

CHRYSLER produces Jupiter (left) and Redstone missiles (right) on parallel lines, using only a part of the 2.1 million sq. ft. Michigan Ordnance Missile Plant outside Detroit.

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Most Payload Capacity, Highest Performance Capability

GENERAL ELECTRIC T58's GIVE NEW VERTOL 107 GREATER CAPABILITY THAN POSSIBLE WITH ANY OTHER AVAILABLE GAS TURBINE

The U.S. Army's recent announcement that it had purchased a quantity of T58-powered Vertol 107 (YHC-1) helicopters was further evidence of the growing trend to employ the General Electric T58 when seeking the powerplant which provides helicopters with highest performance capability.

What makes the T58 so attractive? Compared with other gas turbine engines in its class, the twin-T58 powerplant gives the YHC-1 *at least* . . .

18% MORE INSTALLED POWER—The T58 is guaranteed to deliver 1050 shp.

7% LOWER SPECIFIC FUEL CONSUMPTION—The T58's SFC rate is guaranteed at a low 0.64 lb/hp-hr.

300 LBS. LESS ENGINE WEIGHT, PLUS INSTALLATION WEIGHT SAVING—The compact T58 weighs only 271 lbs.

These outstanding features of the T58 make it the engine with the highest power-to-weight, lowest SFC of any turboshaft flying today—the only gas turbine now available which provides the Vertol YHC-1 with:

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SUPERIOR HOT DAY AND HIGH ALTITUDE PERFORMANCE—Twin T58's have "reserve power" to operate at higher than standard temperatures and altitudes without offloading payload.

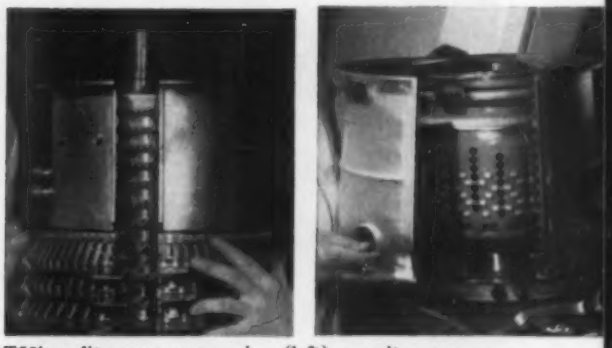
UNPARALLELED ONE-ENGINE-OUT CAPABILITY—Even with one engine inoperative, YHC-1 will still be able to continue missions with the power available from a single T58.

In addition to these operating advantages, T58's are designed for fast and easy maintenance, minimizing helicopter "down-time." When T58-powered Vertol YHC-1's are delivered, they'll give the U.S. Army a full-time airborne mobility never before possible with rotary-wing transports.

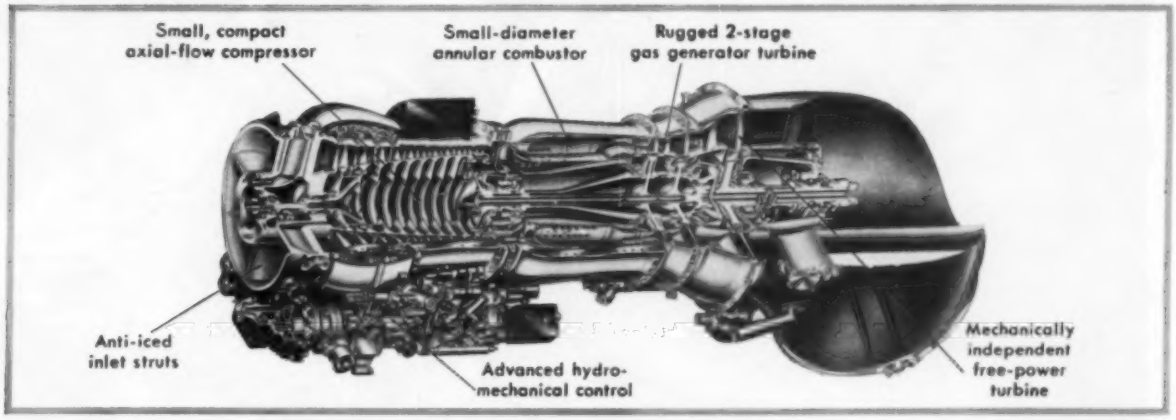
For new brochure, "What Does Engine Weight Mean in Dollars To Helicopter Operators," write to General Electric Co., Section 233–19, Schenectady 5, N. Y.

SOME REASONS WHY THE T58 IS EASY TO MAINTAIN

T58 is easily handled due to its low weight, small size, and unit package design of gas generator and power turbine assemblies. Major components can be disassembled with standard tools and a minimum of special equipment.



T58's split compressor-casing (left) permits easy access for changing compressor blades. Split combustor-casing (right) facilitates combustion liner inspection and fuel nozzle replacement. In the field, these operations can be performed without removing engine from the helicopter.



General Electric T58's near 4 to 1 power-to-weight ratio, 0.64 SFC assure top helicopter performance. Modern aircraft gas turbine design principles and development techniques incorporated in the T58 result in proven ruggedness, reliability. T58 gas turbine state-of-the-art provides helicopter designer and operator with a powerplant with "years ahead" ability.

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On a 300 acre site in Maryland, Thiokol's Elkton Division pursues advanced programs of basic and applied rocket research, development and production.

In current production are rockets for low altitude cockpit ejection systems. One such device—powered with a Thiokol rocket—has been instrumental in saving life in two emergencies.

Nucleus of Thiokol's rocket team was organized at Elkton in 1948. *Recruit*, solid propellant rockets for "Operation Farside" and *Cajun*, for upper atmosphere research, are marked milestones in Elkton's progress.

Equipped with the most modern laboratory, production and testing facilities . . . the Elkton Division is engaged in the development of advanced rocket motors of diversified size and type, of high energy fuels—and their adaptation to military and civilian use.

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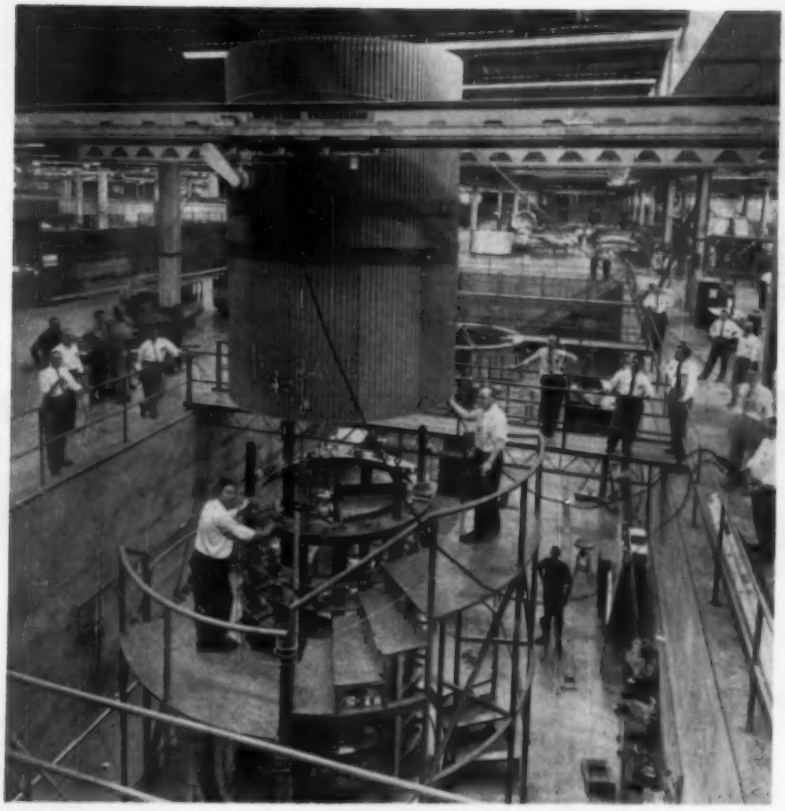
*Registered trademark of the Thiokol Chemical Corporation for its liquid polymers, rocket propellants, plasticizers and other chemical products.



VERTICAL assembly fixture allows several riveters to attach corrugated panels to Z-ring frames to form the main part of the Jupiter tail assembly.

mounts to take the gimbaled Rocketdyne engine are made of steel, the only steel used in the tail. Riveting is done on a multilevel vertical assembly in the deep pit area, allowing work on a number of rings at one time.

Center section, which forms integral tankage for the liquid oxygen and RP-1 fuel, consists of seven mechanically milled skins of 5086 aluminum alloy, .055 in. thick but milled to .040 in. wherever possible to save weight. Skins are rolled into two 180 deg. segments from flat plates and butt welded to form an open cylinder on inert-gas automatic welding machines developed by Chrysler.

Both butt welds are X-rayed 100%. Z-rings and channel rings are then spot welded to serve as structural members. Each "barrel" is then planed in a double-end routing machine and each end is routed simultaneously with both edges parallel to close tolerances.

Number one skin, at the forward end of the container section, takes the upper bulkhead of the fuel tank. It also uses aluminum stiffeners to carry the load of the aft section. Number three skin takes its bottom bulkhead, and number seven skin, closest to the rear, takes the bottom bulkhead of the liquid oxygen tank. Bulkheads are fillet welded by a semi-automatic process. Bulkheads are fabricated on separate welding fixtures and consist of a circumferentially welded cone assembly and a stretch-formed and welded knuckle assembly.

All welds again are X-rayed 100%. Aluminum screen anti-sloshing baffles are fillet welded.

When the "barrel" assemblies are completed, they are placed in a huge circumferential welder and butt welded together to form one large cylinder. Optical alignment technique is used during this process, when tail and center

Transition

Army-Chrysler Redstone 200-mi. ballistic missile, on which early work began in 1950, is deployed in Europe and has been fired 41 times since August of 1953. All firings have been in the U. S. Three were by Army troops, two of them under field conditions and for less than full range.

Most recent firing was conducted last Jan. 19 at White Sands, N. M., by the 209th Artillery Group. The other two were made last year by elements of the 40th Field Artillery Group, which as recently as 25 months ago still had the Army's last mule pack company on its rolls.

PUMP PRIMERS

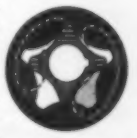
by
Arthur A. Nichols

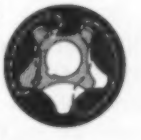
"Why Gerotor Pumps For Servo Control?"

Hydraulic servo systems require a smooth flow of control power between sensing elements and the hydraulic systems that do the actual positioning. This calls for a positive-displacement pump that does not quit at the low end of the speed range.

The Gerotor pump is unique among all positive-displacement pumps designed for servo-control applications because of its exceptionally high volumetric and mechanical efficiency.

High volumetric efficiency is inherent in the Gerotor design and pumping cycle, *(See Fig. 1)*. The Gerotor has only two moving parts — a ring gear and a mating rotor having one less tooth. This "missing tooth" provides the fluid-moving chamber. The difference in number of teeth also causes a slow relative rotation between the two gears. As both gears rotate in the same direction around a single shaft, the chamber slowly opens and fills as it passes the intake port . . . slowly closes and empties as it passes the discharge port. Fluid-tight continuous contact of inner and outer teeth provides high suction, positive pressure and relatively pulseless flow.





High mechanical efficiency maintained over a long service life results from design simplicity which involves just two moving parts with slow relative rotation, a single shaft and closely maintained tolerances. Valveless construction and dynamically balanced parts also contribute to minimum maintenance and quiet operation.

Other applications in the Gerotor pump's 100 gpm and 1000 psi range include hydraulic motors, lube, scavenge and booster service, electronic coolant pumping in aircraft, guided missiles and similar installations.

Technical information plus complete custom engineering and precision manufacturing facilities are available to help you obtain the right pump to meet your performance and housing requirements. Your inquiry is invited.

FIG. 1

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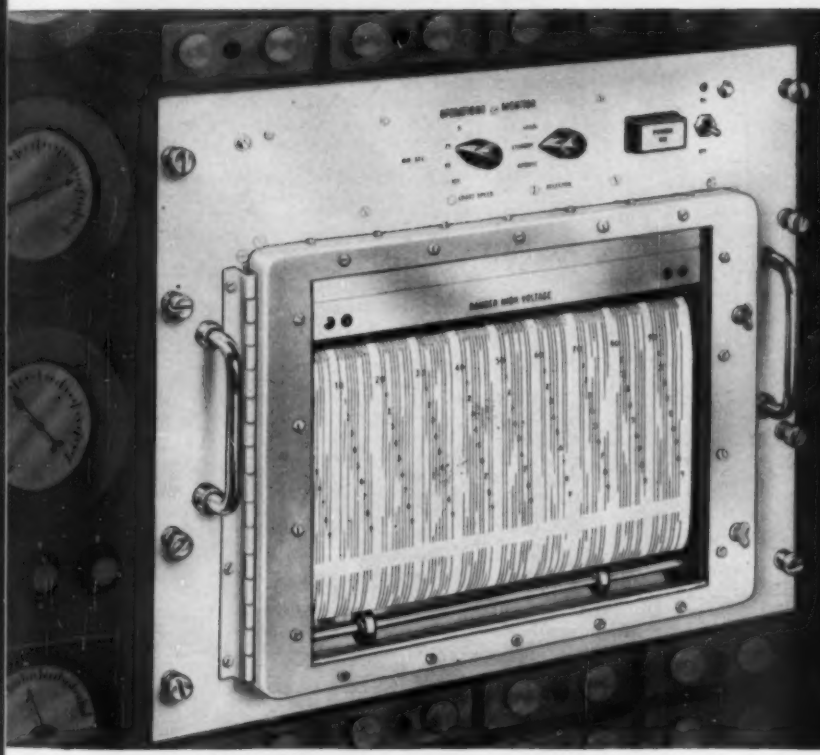
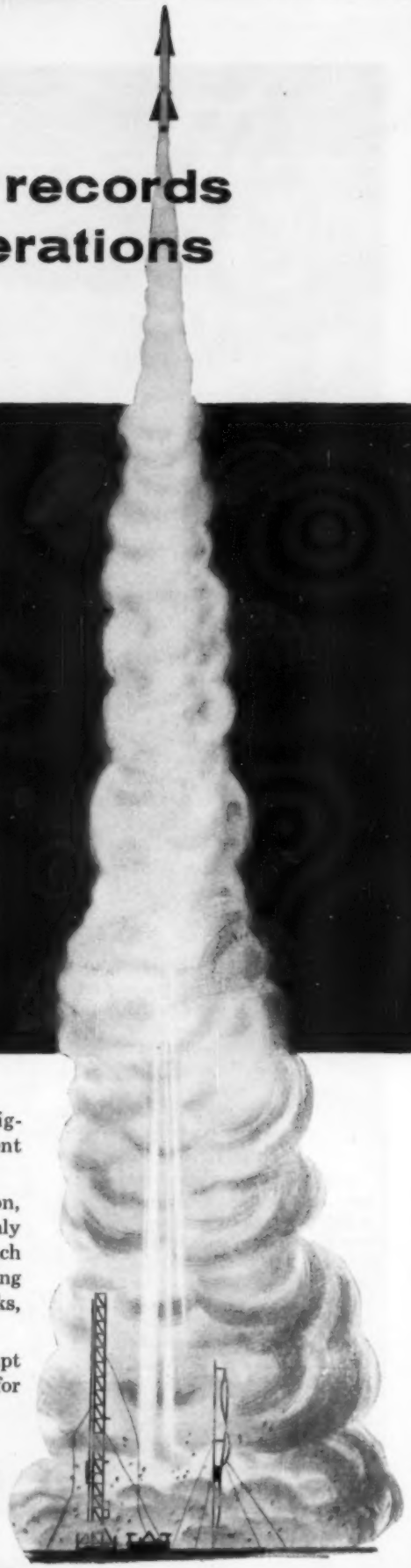
BUILT TO MIL SPECS...

one Brush Monitor records 100 countdown operations simultaneously!





Built to military specifications and performing to extremely rigorous military requirements, the Brush Operations Monitor can prevent aborts and destructs costing millions of dollars.

For quick, accurate and immediately visible go and no-go information, 100 operations are recorded simultaneously on a 500′ moving chart only 12″ wide. You have an *immediate* picture of an entire situation with each event shown in a time relationship to all other events. It is now being used for major check-out of propulsion systems, electrical test racks, fault isolation programmers and launch control vehicles.

Brush is now in production on this Mil Operations Monitor and prompt delivery can be made to your requirements. Phone or wire Brush for complete information and application assistance.

brush INSTRUMENTS

DIVISION OF

3405 PERKINS AVENUE **CLEVITE** CORPORATION CLEVELAND 14, OHIO

Arsenal Evolution

Detroit—"Our so-called arsenals are no longer arsenals in the archaic sense of the days of the Indian wars, when they were used to store arms until they were to be used, but now they are engineering centers . . . to design, engineer the development and, as rapidly as possible, pass on to industry for production. After all, the backbone of the arsenal system is industry. There is no desire nor capability to be a production system competing with industry. . . . On Jupiter, Chrysler has been in on this from its inception."—Brig. Gen. J. A. Barclay, commander of Army Ballistic Missile Agency, at opening of Chrysler Corp.'s Jupiter production line to the press.

"These Redstone and Jupiter missiles are no 'hand built' scientific toys, assembled by bearded scientists in obscure laboratories. They are American industrial achievements, engineered and built in the great American industrial tradition, with the full heritage of American automotive know-how applied to America's major military weapons."—B. J. Meldrum, special assistant to the general manager, Chrysler Missile Division.

section are joined, when the engine is added and when the aft-section, which is the instrument compartment directly behind the nose cone, is connected.

Tail and center section are riveted together in a fixture similar to the circumferential welder, and assume the name of container section. Double-walled, insulated aluminum conduit is used to carry wiring through the section from instrument section to engine and each tank is hydrostatically tested. Dye penetrant added to the water in each tank is examined with black light to discover any leaks.

Once the engine—which must be fitted with hundreds of components and subassemblies after it reaches the Chrysler plant—is installed in the container section and optically aligned, it becomes known as the power unit.

Aft Section

Aft section, shaped like a large truncated cone, consists of a magnesium-thorium skirt section and an instrument compartment. The two are separated by a pressure bulkhead. Skirt is stiffened because this part failed in preproduction structural tests. Both self-sealing rivets and welding are used, and sealer is added after riveting is completed. Instrument section is pressure-checked at this step and again after electronic gear is installed.

After addition of the aft section and nose to the container section, the missile is placed in one of four checkout positions. Systems are checked out completely in a series of tests of increas-

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CBC 843

TAC gets hottest plane flying...F-104C

Tactical Air Command takes delivery of its first F-104 Starfighter

The world's speed record, 1404 mph; the world's altitude record, 91,243 feet; and seven time-to-climb world records are *all* held by the Lockheed F-104 *Starfighter*.

The newest Starfighter models – the F-104C day superiority fighter/bomber, and a two-place tactical trainer, the F-104D – are now flying for Tactical Air Command.

Scheduled to become an integral part of TAC's global air strikeforce, the F-104 Starfighter is armed with a 20 mm cannon that fires at a rate of thousands of rounds-per-minute, and Sidewinder missiles that fly right up the tailpipes of enemy jets.

Like all Lockheed planes the F-104C has built-in stamina that assures maximum utilization and long life – to give the taxpayer and the U.S. Air Force the most defense per dollar.

LOCKHEED

LOCKHEED AIRCRAFT CORPORATION, CALIFORNIA DIVISION

Burbank and Palmdale, California

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ing stages of complexity. Because of the frequency of functional unit tests performed during unit and final assembly operations, the purpose of the final checkout is primarily to test the integrated systems.

First test is a check of continuity and insulation resistance of the missile circuitry.

This is followed by hydraulic and pneumatic system tests, response tests, electrical functional tests and polarity tests of components such as the engine, spin motors, etc.

If the missile carries instrumentation, a complete calibration run is made with a simulated telemetry ground station.

Simulated Flight Test

Climax of the test sequence is a simulated flight test of the complete missile system from countdown through impact.

"During the preparatory 'prefiring' countdown and the actual 'firing,' every possible firing and flight condition is duplicated," according to J. D. Clifford, Chrysler's project manager for the Jupiter.

"This assures an extremely high degree of reliability. The missile as it is shipped from the plant is a completely checked-out unit that can be erected and fired without further functional tests."

Major Subcontractors

Major subcontractors for the Jupiter are North American Aviation Inc.'s Rocketdyne Division for the 165,000 lb. thrust engine, Ford Instrument Division of Sperry-Rand Corp. for the guidance, Goodyear Aircraft Corp. for the nose cone, and Reynolds Metals Corp. for most of the aluminum used in the tankage, tail and aft sections.

Chrysler has a total of 2,409 subcontractors for the Redstone and Jupiter systems, with 1,438 of them in the midwest and 1,008 of them in Michigan.

New York runs second with 230 and California next with 199. Some 70% of Redstone and Jupiter components are interchangeable.

Avion to Produce Titan Radar Beacons

Radar beacons for the nose cone of the Titan intercontinental ballistic missile will be produced by Avion Division of ACF Industries, Paramus, N. J.

Contracts for the radar beacons, totaling $200,000, were let by Avco Manufacturing Co., the Titan nose cone contractor.

Beacons will be used to facilitate radar tracking of the re-entry vehicle during test firings.

MICRO-BEARING ABSTRACTS

by A. N. DANIELS, *President*
New Hampshire Ball Bearings, Inc.

WHY CLASS ABEC 7 BEARINGS?

Improved Running Quality in critical applications is the reason why the Annular Bearing Engineers Committee of the Anti-Friction Bearing Manufacturers Association, Inc., has established Class 7 as the highest United States standard for manufacturing tolerances of miniature ball bearings. Originally available only on order . . . and at premium prices because of selection from ABEC 5 production runs . . . ABEC 7 bearings are now offered by New Hampshire Ball Bearings, Inc., as its minimum standard . . . at no extra charge.

An item-by-item comparison of ABEC 5 and ABEC 7 standards clearly shows how closer tolerances improve running quality.

(COMPARATIVE CHART)

RING		MEASUREMENT	TOLERANCES ABEC 5	TOLERANCES ABEC 7
Both	1.	Radial Runout (T1R) Max.	.0002"	.0001"*
Inner	2.	Side Runout with Bore	.0003"	.0001"
Outer	3.	O.D. Runout with Side	.0003"	.00015"
Both	4.	Parallelism of Sides	.0002"	.0001"
Inner	5.	Groove Parallelism with Sides	.0002"	.0001"
Outer	6.	Groove Parallelism with Sides	.0003"	.0002"
Inner	7.	Bore (I.D.)	+.00000" −.0002"	+.00000" −.00015"
Outer	8.	O.D.	+.00000" −.0002"	+.00000" −.00015"
Both	9.	Width (Individual Rings)	+.000" −.005"	+.000" −.001"**

*ABEC 7 allows .0002" radial runout for outer ring. We hold it to .0001".
**ABEC 7 allows −.005".

Radial Runout . . . the sum of a ring's out-of-roundness and eccentricity . . . is functionally important. In critical high-speed applications, it affects balance and true running. In precise gear trains, it affects backlash and sometimes angular velocity ratio. In closely designed synchros and similar electrical equipment, it affects air gap control. Since most bearings operate with inner ring rotation, you'll notice that ABEC 7 cuts the ABEC 5 allowance in half . . . from .0002" max. to .0001". For the outer ring ABEC 7 makes no change from Class 5's .0002" max. However, modern race grinders work to a nominal zero runout and .0001" max. may usually be expected. Our inspection tolerance, therefore, is .0001". This gives outer-ring rotation applications the same advantages as for inner-ring rotation.

Perpendicularity of raceway planes to axis of rotation is a highly desirable feature. Its probability is determined by the interrelationship of Side Runout with Bore (Inner Ring), O. D. Runout with Sides (Outer Ring), parallelism of sides and groove parallelism with sides of both rings, when bearings are properly mounted and seated. If raceway planes are not perpendicular to the axis of rotation, stresses and torque peaks will be developed within the bearing because of this misalignment unless radial clearance and enlarged raceway curvature are sufficient to compensate. This effect may be observed in clamped, preloaded duplex bearings by shifting the relative position of the rings, reclamping and feel-testing.

Notice that the five perpendicularity features (2 through 6 in the chart) have much lower allowances in ABEC 7 than in ABEC 5. These differences in angular inaccuracy mean much in running quality as bearings become smaller. For example, non-parallelism of .0002" on a ⅜" O.D. (R 2 bearing) represents an angular error of about 2 minutes. But, on a 3/16 O.D. (R 1 bearing), the same allowance means 4 minutes of angular error. That's why ABEC 7 reduces allowances by one half or more. The importance of minimizing angular error is also reflected in the AFBMA tables of allowances, which are generally reduced within each class as size of bearing is reduced.

Envelope Tolerances (7, 8, and 9 in the chart) make little or no difference in running quality. The only ABEC change is from bore tolerance of plus 0, minus .0002 in Class 5 to minus .00015 in Class 7. This permits mounting bearings to a narrower spread of fits. Although ABEC 7 allows the same O.D. and width tolerances as for ABEC 5, we have reduced O.D. tolerance to plus zero, minus .00015" and, together with other manufacturers of instrument bearings, have reduced width tolerance to minus .001. The latter minimizes variation in axial spacing of assemblies.

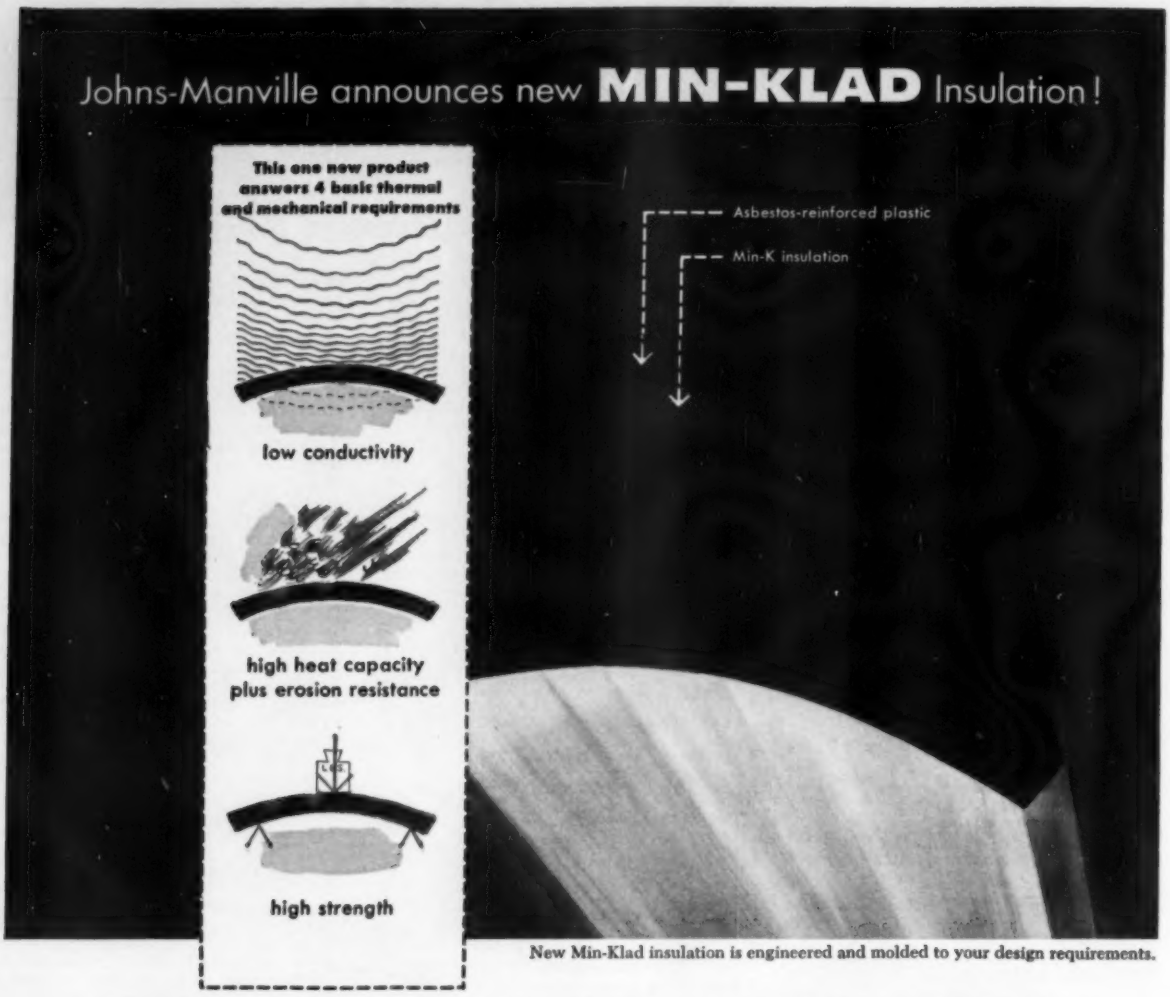
Other Factors that affect running quality of bearings are not covered by ABEC standards. They include: truth of raceway geometry, surface finishes, retainer design and finish, radial and axial play and some ball qualities. These are discussed in our design handbook.

DESIGN HANDBOOK OFFERED FREE

You'll find this up-to-the-minute, authoritative 70-plus-page publication a great help in designing instruments or small electromechanical assemblies. Write to New Hampshire Ball Bearings, Inc., Peterborough 1, N. H.

NEW HAMPSHIRE BALL BEARINGS, INC., PETERBOROUGH 1, NEW HAMPSHIRE

Johns-Manville announces new **MIN-KLAD** Insulation!


This one new product answers 4 basic thermal and mechanical requirements
low conductivity
high heat capacity plus erosion resistance
high strength
Asbestos-reinforced plastic
Min-K insulation

New Min-Klad insulation is engineered and molded to your design requirements.

Combines the capabilities of asbestos-reinforced plastic with the dramatically low conductivity of MIN-K insulation!

New Min-Klad insulation may well be the most significant advance ever made in missile and rocket insulation.

Developed by Johns-Manville research scientists, Min-Klad is the only product of its kind, a permanent lamination of the missile industry's two most effective high-temperature materials: 1) reinforced plastic and 2) J-M's recently developed Min-K insulation.

Does more than plastic alone

Min-Klad gives the missile designer all the advantages of high-temperature plastic: Strength, toughness, rigidity! Erosion resistance! High heat capacity! Yet Min-Klad does more.

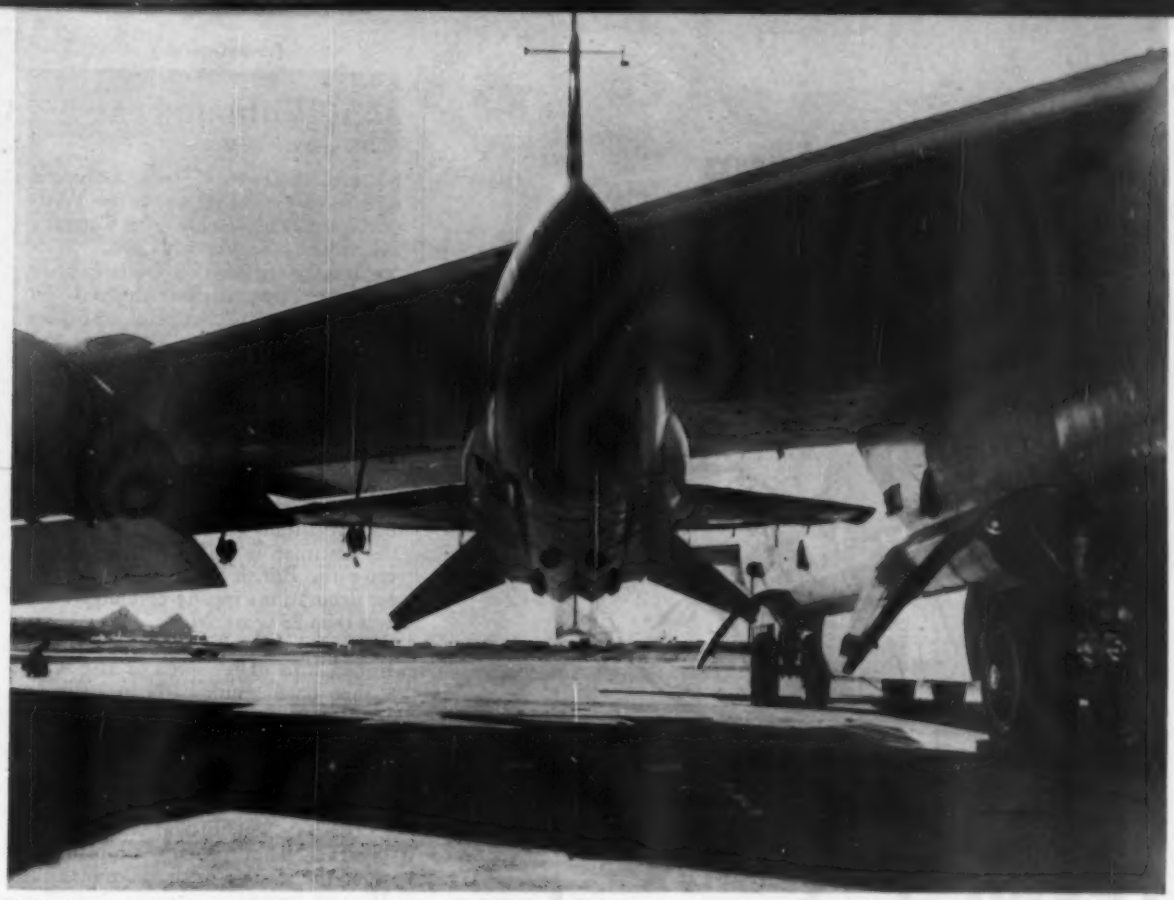
It also insulates . . . and with dramatic effectiveness! Its insulating element is J-M's Min-K, an insulation with thermal conductivity that is lower than any other known insulation. Actually lower than the molecular conductivity of still air. And this conductivity (already less than half that of the best fibrous insulations) drops still further with altitude. At 10 miles, for example, it is decreased by as much as 40%, with further decreases at greater altitudes.

Wide range of applications

Min-Klad offers the missile and rocket designer a rich choice of heat-control possibilities. It may be used for a part that must insulate, yet have the structural advantages of plastic. Where requirements call for a scuff- and erosion-resistant insulating surface . . . or for a good adhesive bond between Min-K insulation and other surfaces. Or, it may be used to control high transient temperatures! For high heat capacity of asbestos-reinforced plastic combined with the low conductivity and heat capacity of Min-K result in a product that provides minimum heat transfer under transient conditions.

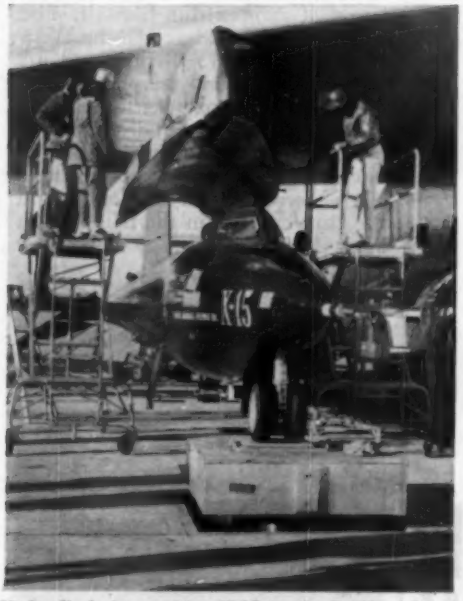
Min-Klad is now being tested for approximately two dozen missile and rocket designs. Why not investigate this new material for your present thermal requirements? Upon request, we'll be pleased to send you a sample of the material along with detailed technical information. Write Johns-Manville, Box 14, New York 16, New York. (Ask, too, for information on Min-K insulation and the new aviation insulation brochure IN-185A.) In Canada: Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS



North American X-15 research plane is mated to wing of Boeing B-52 jet bomber in preparation for first flight at Edwards AFB.

Wing Pylon Secures X-15 Research Plane to B-52



Hydraulic hoists position X-15 in the B-52's right wing pylon (left). Hand cranks slung from wing (right) are used for final positioning. Wings are covered with protective canvas. The X-15 received exhaustive resonance tests after the installation was made (AW Feb. 2, p. 28) to determine compatability between the two aircraft. Fuselage fairings house propellant and control lines.

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LEACH electronic relays

Leach adds new meaning to reliability with electronic relays that eliminate the problems of failure due to vibration and shock... internal contamination... malfunction at elevated ambients.

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- Leach electronic relays are magnet coil wound with Teflon insulated magnet wire on a one-piece Kel F bobbin.

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(Advertisement)

Man Without Fear

(Continued from Inside Back Cover)

his total kills to 47 in less than 3 months of combat flying on the Western Front. This exploit won Canada's Billy Bishop the Victoria Cross.

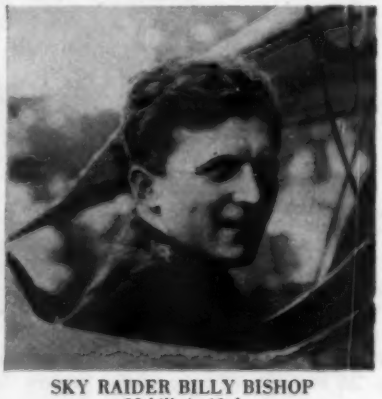
Armed only with two rifle-caliber machine guns, Bishop showed the world what a fighter pilot could do with a 113-hp. plane that had a top speed of 107 mph. In less than six months, he fought 170 air battles and scored 72 victories—25 of them in just 12 days. As a veteran of only six weeks at the front, he once engaged 23 different enemy aircraft in a single day.

For his bravery in the air, Toronto-born William Avery Bishop became the first man in military history to receive the British Empire's three highest decorations in one ceremony. He was then 23 years old.

Like Germany's Baron von Richthofen and other aces of the war, Bishop hated mud. Early in 1917, he left the Canadian Mounted Rifles to join the Royal Flying Corps as an air observer. In March he became a fighter pilot. Unlike the Red Knight of Germany, who waited for the enemy to come to him, Bishop was a raider. His French-built Nieuport biplane became the scourge of the skies over the Western Front.

Bishop relied on Corporal Walter Bourne, a conscientious British mechanic, to keep the Nieuport—particularly its temperamental LeRhone rotary engine—in fighting shape. He cared for his guns and checked each round of ammunition himself. The Nieuport was introduced on the Western Front in 1915. Bishop and his fellow airmen found the plane highly maneuverable, despite its tendency to shed its wings in a speed dive.

The Canadian ace scored 47 kills in Nieuports before he was ordered on a tour of recruiting duty in Canada and the United States in the fall of 1917. He later was ordered to set up a fighter



SKY RAIDER BILLY BISHOP
...25 kills in 12 days

(*Advertisement*)

squadron, and in June, 1918 the General Staff ordered him to report to London to begin organization work on what was to become the Royal Canadian Air Force. In the 12 free days he had left before reporting to London, Colonel Bishop went hunting in the skies over enemy territory. He brought down another 25 planes.

Bishop was never wounded in the war, nor did he have an aircraft accident—a remarkable record in itself. He returned to peacetime life unaware that he would be back in uniform 21 years later—as a full Air Marshal.

Until Bishop's death in 1956, he maintained a close friendship with his front-line mechanic, Walt Bourne. When he was buried in Toronto with full military honors, a dozen jet-age fighter planes from the air force he inspired dipped their wings in homage to Billy Bishop—the man who was without fear.

Heritage of the Air

One of the most inspiring chapters in the history of flight is the story of the men and flying machines of World War I. It is a highly personalized story of brave men—and the wood, wire and linen that converted manpower to airpower.

From the open-cockpit, helmet-and-goggles era to the space age, the Leach Corporation has served aviation with active components of unsurpassed reliability. Because it shares the many fine traditions of aviation, Leach is proud to present this Heritage of the Air Series.

Free Reprints for Framing...

Color prints of the cover illustration of Col. Billy Bishop's Nieuport and other World War I planes are available for framing. Reserve a set of these collector's items—complete with scale drawings and specifications—by addressing requests on company letterhead to: Heritage of the Air, Leach Corp., 18435 Susana Rd., Compton, Calif.

gnat on the nose of a missile

ACTUAL SIZE

newest new product from INET!

The compact, self-contained unit shown here is Inet's new 6-ounce Triaxial Recording Accelerometer...so small it can be attached to a 1½ in. radius missile nose section.

This rugged unit has three sensing elements—reeds—that directly sense and record data on structures and components subjected to high-acceleration loads. It operates on 6 volts in a temperature range of −50° to +160°F., requires no connections to external devices except a power source. The unit records data on acceleration-time history along each of three mutually perpendicular axes...in a transverse reed range of 1,500 cps, 250-7,500 G... and in a longitudinal reed range of 2,000 cps, 400-10,000 G.

Inet's Triaxial Recording Accelerometer is available for immediate delivery—for use in water-entry shock studies; ground impact, blast, and explosion studies; and for other tests, including rocket motor, target impact, sled, and switch actuation tests.

Write today for further information.

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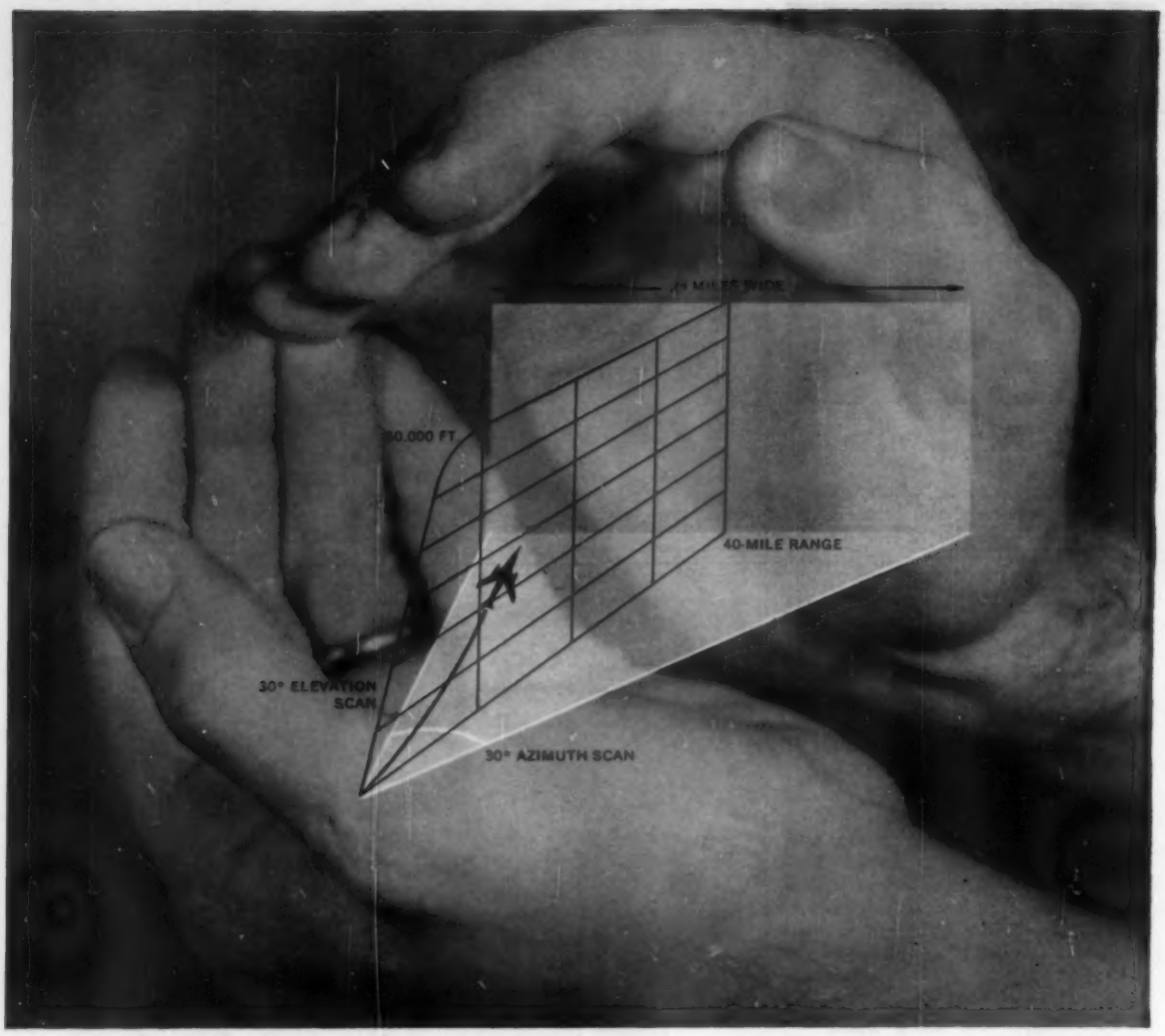


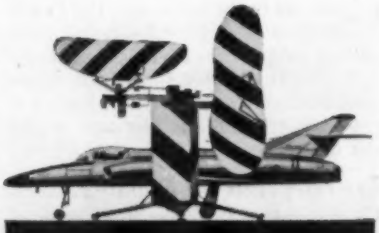
Gilfillan Quadradar first proven navigational aid for the safe handling of supersonic jet aircraft!

Versatility and reliability of the Gilfillan Quadradar has been proven for over two years in more than 150 installations around the world! Gilfillan Quadradar has a three-dimension approach and departure coverage 40 miles long, a 24-mile wide "gate" and altitude coverage of 50,000 feet to permit a straight-in jet penetration and safe high-angle climb-outs.

Quadradar's 360-degree surveillance and height-finder system permits rapid, tight three-dimension control of traffic patterns within an area of 5,000 square miles. Pilots can be informed of position of all other aircraft within the terminal area, reducing collision hazards. Using its jet penetration function in reverse, Quadradar provides safe control during Mach plus high-angle climb-out, even in high-density traffic. The versatility and terminal area safety features during penetration and high-angle, high-speed climb-outs of jet aircraft have been established by the U.S. Navy, the U.S. Air Force and by Lockheed, Douglas, Convair, North American and Hughes Aircraft Companies in actual operation at Moffett NAS, Castle AFB, and at Palmdale Flight Test Center.

Quadradar's unique versatility is providing air traffic controllers with accurate, safe altitude separation, monitored TACAN approaches, thunderstorm avoidance, and multiple runway coverage. It is also used as a toss-bomb trainer.

Gilfillan's manufacturing experience since 1912 and creative capabilities in the fields of Air Navigation, Radar Trainers and Ground Support Equipment, Electronic Countermeasures, Missile Systems and Instrumentation, are available for complete research, development and production in these and related fields.



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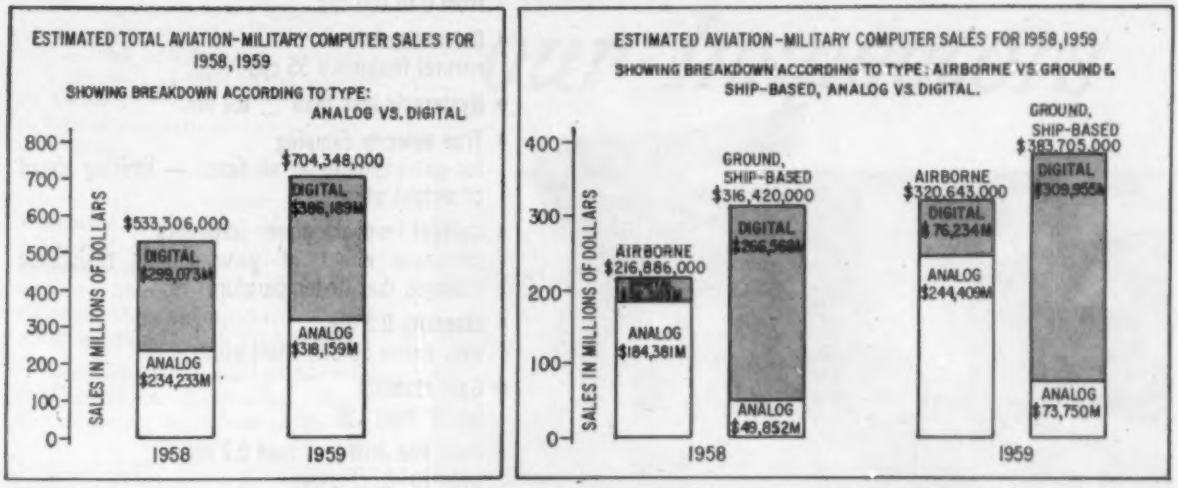


AVIATION WEEK survey of computer manufacturers reveals for first time the size of the aviation-military market for computers and shows how market is divided between analog and digital type computers for airborne and ground/shipboard applications.

Survey Shows Size of Computer Market

By Philip J. Klass

Washington—More than half a billion dollars worth of analog and digital computers were sold last year for aviation and military use and the figure probably will exceed three-quarters of a billion dollars in 1959, an AVIATION WEEK survey revealed.

The survey also disclosed how the market is divided between analog and digital type computers and between airborne and ground/ship-based applications. Results, based on responses from 32 computer manufacturers out of 57 queried, include practically all the major suppliers.

Total computer sales for the 32 manufacturers for 1958 were estimated at $533.3 million. For 1959, the figure is estimated at $704.3 million, a 32% increase over the previous year. Total industry sales figures, including companies that did not participate in the survey, possibly run 10% to 20% higher —but this is only a speculative estimate.

Sales of Computers

Sales of airborne computers in 1958 were estimated at $216.9 million, representing approximately 41% of the total; the remaining 59% represented ground- and ship-based computers. In 1959, airborne computer sales are expected to climb to $320.6 million and to account for 46% of the total, AVIATION WEEK's survey indicated.

The survey revealed that digital computers now hold slightly more than half the aviation-military market, with total 1958 sales of $299.1 million and estimated sales of $386.2 million in 1959. This is a substantial market for a device which only 10 years ago was little more than a laboratory curiosity.

Despite widespread development activity under way in airborne digital computers, the survey indicated that analog computers still constitute the bulk of current airborne computer production. In 1958, airborne digital computer sales were $32.5 million for the companies surveyed, representing 15% of the total $216.9 million airborne computer market.

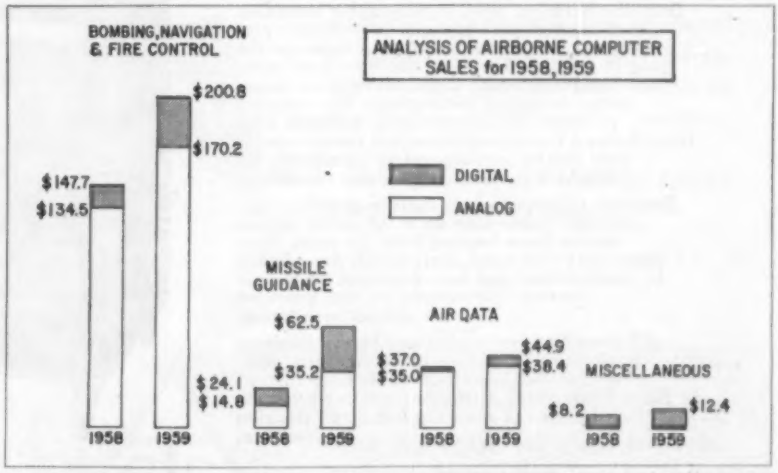
However, in 1959 airborne digital computer sales are expected to jump 135% to $76.2 million, giving them approximately 24% of the total $320.6 million airborne computer market. The 1959 airborne computer sales represent a 48% increase over total airborne sales for 1958, the survey showed.

In ground- and ship-based applications, the digital computer already has taken a commanding lead over the analog type.

Of the total 1958 sales of $316.4 million, digital computer sales of $266.6 million represented 84%.

Estimates for 1959 predict a 20% increase in total sales of ground- and ship-based computers, for a figure of $383.7 million. Of this figure, $310.0 million represent digital computers, corresponding to 81% of the total.

Although this might suggest a slight



ANALYSIS of airborne computer sales, according to application and type, reveals that analog type still dominates current production but there is a trend to digital type computers.

- **Flat frequency response** from 0 to 100 cps
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- **True velocity damping** for galvanometer at all times — limiting ahead of output stage
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- **Automatic stylus heat control**
- **Inkless recording** in true rectangular coordinates

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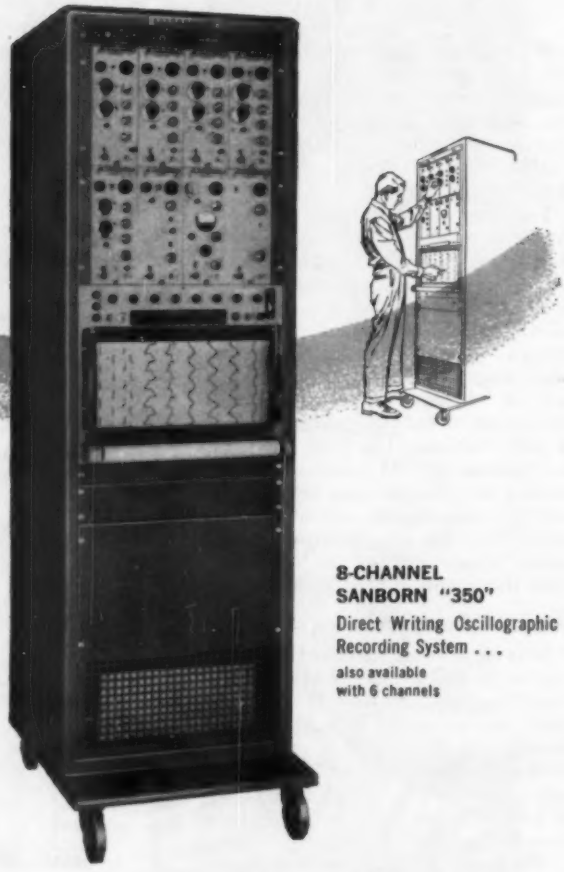

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Recorder features include built-in paper footage indicator, paper take-up, 8" of visible record, simple paper loading from the front. Nine electrically controlled chart speeds are selected by pushbuttons, and have provision for remote control. Connections are also provided for output monitoring.

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slippage in the digital computer's share of ground- and ship-based computer production, comments by manufacturers suggest that this does not indicate a trend back to analog computers.

A summary of total figures obtained in AVIATION WEEK's survey, according to type of computer and application, is as follows:

	1958	1959
	(Millions of Dollars)	
• **Airborne Total:**	$216.9	$320.6
• **Airborne Analog:**	$184.4	$244.4
• **Airborne Digital:**	$32.5	$76.2
• **Ground-Ship Total:**	$316.4	$383.7
• **Ground-Ship Analog:**	$49.9	$73.8
• **Ground-Ship Digital:**	$266.6	$310.0

Manufacturers were asked for a further breakdown of estimated sales figures, according to end-use of the computer. For airborne computers, four categories listed were: bombing, navigation and fire control; missile guidance; air data; miscellaneous. For ground- and ship-based computers, four categories were: guidance and fire control; logistics; scientific; miscellaneous.

Airborne Computers

The survey showed that a substantial portion of current airborne computer production is going into aircraft applications, but the missile guidance portion is growing. Approximately 68% of total 1958 airborne computer sales, or $147.7 million, was listed under the category of bombing, navigation and fire control, while 11%, or $24.1 million, was listed for missile guidance.

For 1959, manufacturers' estimates showed that bombing, navigation and fire control computer sales of $200.8 million will represent 62% of total airborne sales, while missile guidance computer sales of $62.5 million will have increased to 19% of the total airborne market.

Analysis showed that for bombing, navigation and fire control, digital computers make up 9% of the total for this category in 1958, increasing to 15% in 1959. For missile guidance, digital computers constitute 39% of the 1958 total for this category, increasing to 44% of the total for this category in 1959, according to the survey.

Air data computers (used to compute barometric altitude, airspeed and Mach number) represented a $37.0 million market in 1958, with only 5% of this figure being digital types. In 1959, approximately 14% of the estimated $44.9 million sales are expected to be digital types.

Of the $225.3 million in ground- and ship-based computers sold in 1958 for guidance and fire control, approximately 90% ($202.1 million) were dig-

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...NEWS IS HAPPENING AT NORTHROP
Latest Astronertial Navigation and Guidance system is revealed by Dr. William L. Parker, Chief of Systems Development at Nortronics, a division of Northrop Corporation.

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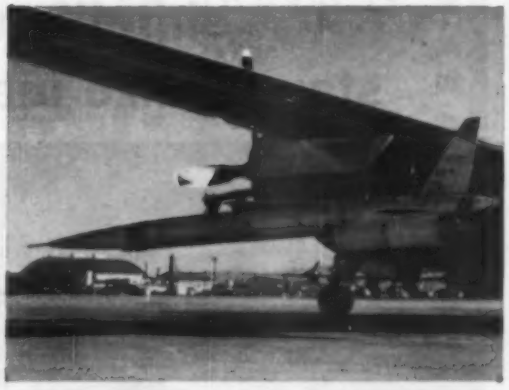

Demanding test for advanced U.S. weapon systems is the XQ-4 supersonic target drone, soon to be followed by the even faster and more sophisticated XQ-4A.

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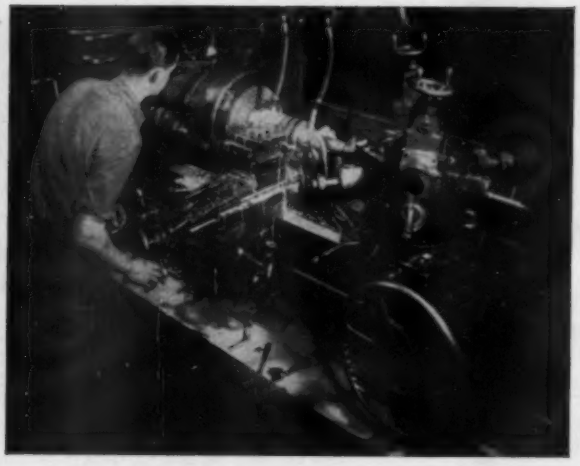

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Participating Companies

Following is an alphabetical listing of the 32 computer manufacturers that participated in Aviation Week's aviation-military computer market survey: AC Spark Plug Division of General Motors, Airborne Instruments Laboratory, American Bosch Arma Corp., Burroughs Corp., Burroughs ElectroData Division, Collins Radio, Curtiss-Wright Electronics Division, Eclipse-Pioneer Division of Bendix Aviation, Emerson Radio & TV Research Laboratories, General Electric Computer Dept., Heavy Military Electronic Dept. and Light Military Electronic Dept., General Mills Mechanical Division, Hoffman Electronics Corp., Hughes Aircraft Co., International Business Machines Corp., Kollsman Instrument, Lear, Inc., Link Aviation, Litton Industries, Melpar, Minneapolis-Honeywell, North American Aviation Autonetics Division, John Oster Manuf. Co., Packard-Bell, Radio Corp. of America, Thompson Ramo Wooldridge Corp., Remington Rand-Univac, Servomechanisms Inc., Sperry Gyroscope Co., Stavid Engineering Co., Westinghouse Electric Air Arm Division.

To encourage companies to participate in the survey, and provide realistic figures, Aviation Week assured manufacturers that figures for individual companies would not be published or in any way disclosed.

ital types. Sales in 1959 are expected to reach $261.6 million, of which 88% are listed as digital.

All the logistics computers are digital, and practically all the computers listed for scientific use also are digital. The latter figure does not accurately depict the situation because the largest manufacturers of analog computers for laboratory use declined to participate in the survey.

In the miscellaneous category, which includes such things as ground check-out equipment computers, approximately 50% of the $53.4 million sales shown for 1958 are digital, while 36% of the estimated $66.4 million 1959 sales are listed as digital types.

Aviation Week's survey asked for manufacturers' comments on computer trends during the next five years, specifically on the matter of analog vs. digital and on the subject of computer size, weight and complexity.

Responses revealed almost universal agreement that there is a pronounced trend toward digital computers, but a number of companies expressed the view that there will still be an important role for analog type computers in military applications. Two predominant reasons for the trend to digital computation, listed in many comments:

• **Versatility:** Ability of a digital computer to perform a number of different computation functions and the need for integration of many of these functions give it a size and weight advantage over many different specialized analog computers.

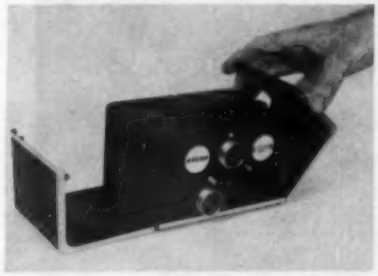
• **Accuracy:** Increased accuracy required for many military applications can be achieved far easier with digital techniques than with analog techniques.

One company commented: "Avionics manufacturers will either have to build up a digital computer capability or team up with a company that does have this know-how through the group-bid approach."

Practically all the companies surveyed agree that computer complexity will increase to achieve greater accuracy, computational speed and capacity. Despite this, nearly all of them expect size and weight to decrease through use of new solid-state devices and micro-miniaturization construction.

Size and weight reduction of airborne digital computers may also be expected through development and use of digital sensing devices. This will minimize the need for analog-to-digital and digital-to-analog conversion in the computer, several manufacturers say.

The trend toward airborne digital computers which combine general purpose and digital differential analyzer techniques was foreseen by several companies. Possible use of combination analog-digital computers was suggested by another.



Airborne Oscillograph

Miniature multi-channel oscillograph, weighing only 3½ lb., can record six continuous analog data channels and three on-off functions simultaneously with accuracy quoted at better than one per cent. Device measures 6¼ x 4¼ x 4 in. Continuous running time of one minute to 50 hr. is obtainable, depending upon film speed. Oscillograph uses moving-coil type mirror galvanometers with micro-ampere sensitivities and frequency response that is flat out to 450 cps. Oscillograph, based on French design, can be obtained in smaller and larger versions, with up to 10 analog data channels. Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.

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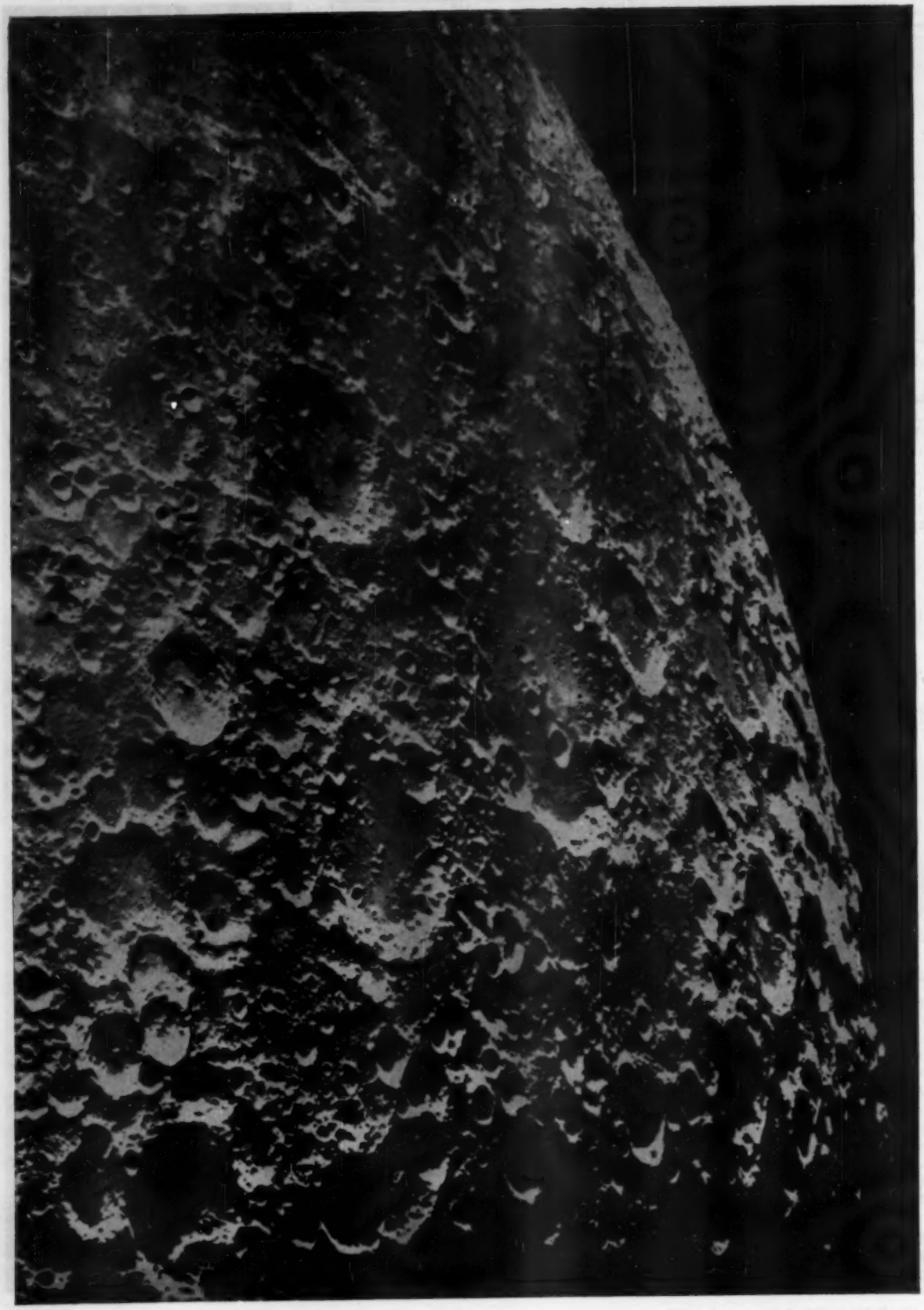

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*The Space Flight Division is one of the 7 divisions of Martin

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Expansions, Changes In Avionics Industry

General Electric's Light Military Electronic Department (LMED) will construct a new 52,000 sq. ft. facility for its Advanced Electronics Center at the new Industrial Research Park being established by Cornell University. The two-story structure, when completed in 1960, will house engineering offices and laboratories and is expected to employ 250-300 persons.

Other recently announced expansions and changes in the avionics field include:

• **Texas Instruments Inc.** has started work on a 192,000 sq. ft. addition to its present 310,000 sq. ft. Semiconductor-Components Division manufacturing plant in northeast Dallas. Completion is expected within 12 months.

• **Airpax Electronics Inc.** is the new name of the former Airpax Products Co., Cambridge, Md., and Ft. Lauderdale, Fla.

• **Radio Corp. of America** has begun construction of a missile and radar facility at Van Nuys, Calif. Initial construction will consist of three engineering buildings, an administration building and a manufacturing building with total of 220,000 sq. ft. of floor space. Occupancy is scheduled for late summer. Initial projects include missile checkout and launch equipment, information handling and radar systems.

• **Burroughs Corp.** will build a new 87,000 sq. ft. addition to its Tireman Avenue plant in Detroit and plans to add 400 persons to the present 2,300-man force. Facility is used for company's SAGE air defense and ballistic missile guidance computer work.

• **Sprague Electric Co.**, North Adams, Mass., has purchased magnetic component and filter product lines of Hycor Division of International Resistance Co., Philadelphia. Sprague will produce magnetic devices and precision bandpass filters at its Visalia, Calif., and North Adams plants and will be sold under company's own trademark. IRC Hycor Division will continue to produce precision resistors, which are not involved in the transaction.

• **Sylvania Electric** will open this month a 30,000 sq. ft. division headquarters and fabrication facility for its Electronic Systems Division in Waltham Industrial Center, near company's Waltham Laboratories.

• **The Oxford Co.**, Buffalo, N. Y., is a new company which will develop precision instrumentation, automatic controls and optical systems. George A. Reed is president. Company's address: 6589 Main St.

• **Acromag, Inc.**, Detroit, has moved its entire manufacturing operations to larger facilities at 22508 Telegraph

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Road, but maintains general offices and the engineering department at 22519 Telegraph Road.

• **Servo Corp. of America** will build a new 120,000 sq. ft. plant in Hicksville, L. I., N. Y., in which company will consolidate engineering, manufacturing and administration operations now located in six plants. Occupancy is slated for August.

• **Radiatronics, Inc.** is a new company which will develop and manufacture radar, communications, telemetry and microwave equipment. George E. Hewitt is president. Company address: 5956 Kester Ave. and 14812 Oxnard St., Van Nuys, Calif.

FILTER CENTER

▶ **Digital Voice Communications Near** –Recent progress in converting voice into digital (pulse-coded) format and back into voice suggests that digital voice communications requiring bandwidths of the order of 150 cps. instead of the conventional 3,000 cps. may not be far off.

▶ **Digital Transducer Procurement**– Contractor proposals for digital transducers, capable of measuring altitude, airspeed, temperature and other functions and providing digital type output without analog-to-digital conversion, are being evaluated by Wright Air Development Center's Weapons Guidance Laboratory. Use of direct digital transducers is expected to permit considerable reduction in size and weight of airborne digital computers.

▶ **New USAF Connector Spec**–Specification for new crimp-type solderless connector, slated to become Air Force standard, will be submitted shortly for industry comments. Connector design is suitable for operation at temperatures tip to 450C. New connector spec, which incorporates features from number of different manufacturers' designs, was developed by Wright Air Development Center's Electronic Components Laboratory and Weapons Guidance Laboratory.

▶ **Reliable Drone Guidance** – Radio command system developed by Sperry Gyroscope Co. for use with QF-80 drones has racked up extremely reliable record, according to USAF. Air Force has lost average of only one drone for every 79 missions, due to failure of remote guidance system. One QB-17 equipped with Sperry system has accumulated 500 hr. flying time, equivalent to 100 missions, without loss of airplane due to malfunction. System is an FM/FM command system operating in UHF band.

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*See NEL Reliability Design Handbook, Sec. 502–"Improved Type Miniature Tube Shields," OTS–Jan. 15, 1959

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COST STUDIES indicated that prices of optimum Army design (left) and stripped model (right) would not vary drastically.

Hiller Studies Minimum-Cost Helicopters

Primary deterrent to adequately developed, low over-all cost helicopters is the present military policy of separate budget funding for procurement and operation, according to a Hiller Aircraft Corp. engineer who has made a detailed study of sources of rotary wing development and manufacturing costs.

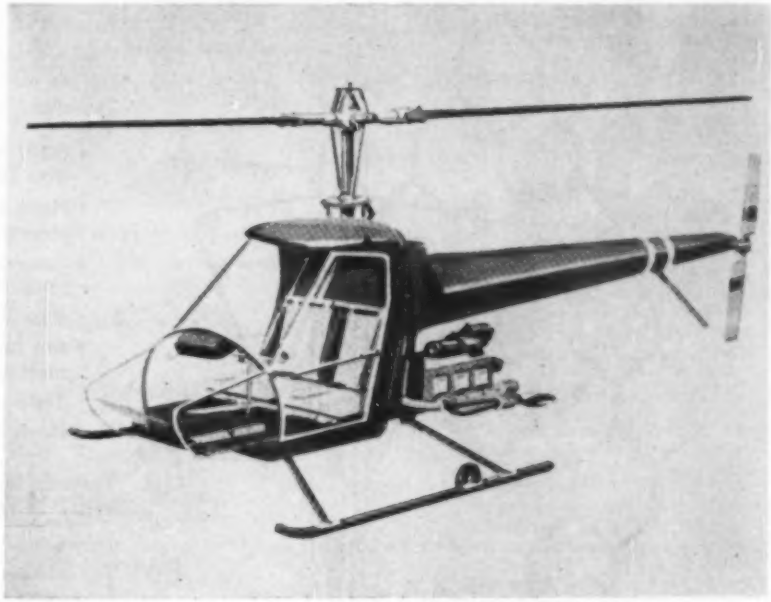
Because procurement and operating funds are authorized separately, a policy has developed of purchase of low first cost undeveloped equipment which throws a continuing burden on operating funds which are "in somebody else's pocket," he notes. Higher operating costs in turn reduce the chances of new equipment being purchased, J. B. Nichols, Hiller Aircraft Corp., noted during the 27th annual meeting of the Institute of the Aeronautical Sciences.

Cost Transferral

The way out of this dilemma is to permit transferral of operating costs funds into the procurement budget, providing an incentive to reduce the former so as to provide additional money for development which would lead to more adequate equipment reaching the user, he claimed.

Development costs, the Hiller engineer noted, represent the smaller percentage of introducing a new helicopter into the field. Any insufficiently developed machine requiring a substantial number of corrective changes in its life represents a very poor bargain, he pointed out.

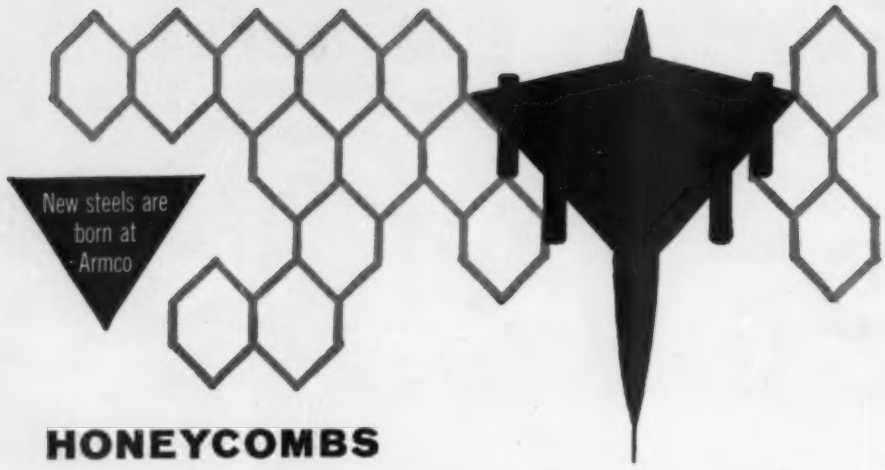
According to Nichols, to date no helicopter has ever entered the field in an adequately developed state—the result being that all helicopter production programs are replete with corrective Engineering Change Proposal (ECP)



COMPROMISE configuration is more operationally suitable than minimum design (above, right) and is designed for simple conversion from piston to turbine powerplant.

Estimated ECP Costs

ITEM	NO. ECP'S ANALYZED (Random Sample)	AVERAGE COSTS	TOTAL NO. ECP'S	TOTAL COSTS
Engineering	52	$3650	160	$584,000
Tooling	28	1550	160	248,000
Tech. Orders	75	501	160	80,160
Sub-Total				$912,160
Retrofit Costs	80	$136	20,518 kits	2,790,440
Estimated Total				$3,702,600



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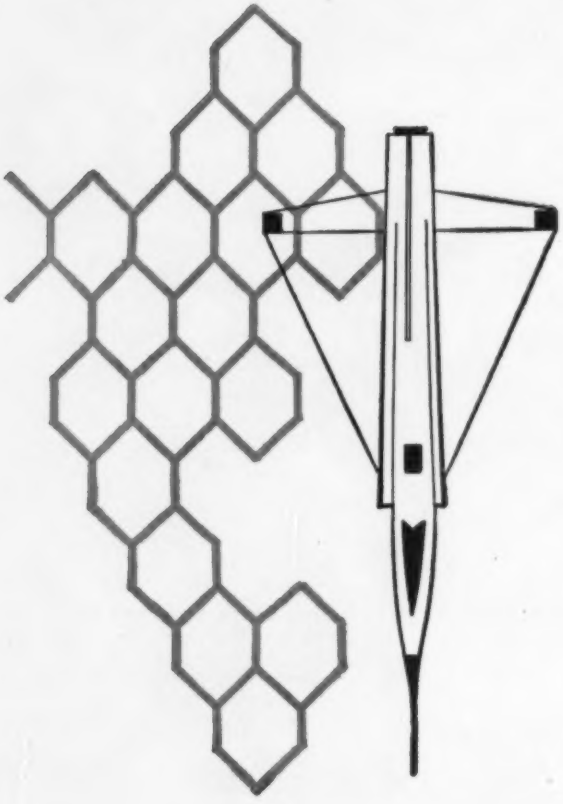

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CONFIGURATION M: Gross Weight 1796 lbs.
CONFIGURATION MC: Gross Weight 1879 lbs.
CONFIGURATION AO: Gross Weight 2444 lbs.
CONFIGURATION MO: Gross Weight 1944 lbs.
CONFIGURATION AC: Gross Weight 2028 lbs.
CONFIGURATION O: Gross Weight 1687 lbs.
CONFIGURATION AM: Gross Weight 2360 lbs.
CONFIGURATION OC: Gross Weight 1820 lbs.

HILLER STUDIES on new light Army reconnaissance helicopter covered extremes of minimum and optimum performance types with compromise design possibilities, with purposeful variations made in type and arrangement of basic components to study relative performance, weight, production cost and maintenance cost.

costs. A larger portion of ECPs are, in fact, nothing more than a continuation of an incomplete development program.

In an analysis prepared of helicopter ECP costs, he noted that such costs for a typical small Army helicopter over a 10 year period equal or exceed the "official" cost of development of the original design. And if costs of actual maintenance labor, supply system distribution, loss of aircraft utilization, administrative function and value of obsoleted parts are added to these obvious costs, it is probable that the over-all ECP program costs two or three times that depicted. Only corrective ECPs, not growth potential ECPs have been considered, he added.

Cost aspects of new helicopter design were developed during a Hiller study of a two-place rotary wing aircraft to meet an Army Transportation Research & Engineering Command design competition for a new vehicle to replace its three-place Hiller H-23 and Bell H-13 types.

Hiller approaches ranged from what it considered to be an optimum two-place design with a gross weight of 1,687 lb. to a stripped-down, minimum-cost vehicle, these extremes being augmented with six compromise possibilities. Type MO, one typical compromise, was more operationally suitable than the minimum-cost proposal and was designed specifically to be converted easily from a piston engine to a turbine powerplant.

Design Variations

In design of the various configurations, variations were purposely made in choice of type and arrangement of components, each class of component being analyzed separately, where possible, for relative performance, weight, production cost and maintenance expense.

In addition, there were some other facets considered. For example, some Army sources believed that the pilot should not have to concern himself with tail rotor clearance in tight spaces. This meant the tail rotor should not extend outside the main rotor disk—resulting in power and payload penalties in those designs employing short tail booms.

A standard design was chosen to ex-

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amine the effects of variables in specification on gross weight and cost. This standard design represented a hypothetical new two-place design which met all the specifications.

Each of the varying designs met the given minimum specifications–some with wide margins and some just barely, the Hiller engineer noted. There were also wide variations in pilot comfort, austerity and other non-specification items.

A standard design was chosen to examine effects of variations in specification on gross weight and cost. This design represented a hypothetical new two-place configuration meeting all of the specifications and had conventional design features, equipment and fittings. Then each of the specification variables were varied independently, these including engine type (piston or turbine), fuel type (aviation or auto gas) rotor time delay, overhaul life, equipment, hover ceiling, endurance and payload.

New Weights

As each of the specifications were varied, a new minimum gross weight was obtained representing optimum designs. An International Business Machines computer program was used in this phase of the study by Hiller.

Design and specification study results were converted to actual dollar cost figures from 34 separate vendors who provided bids on rotor blades, engines, transmissions, instruments, electrical and hydraulic equipment, forgings and extrusions. Hiller's own manufacturing department submitted competitive cost bids where applicable.

The study considered that all costs that occurred before production started of a fully qualified helicopter should be defined as development costs, including engineering development, tooling for the contemplated total quantity and manufacture of preproduction aircraft. Inclusion of production tooling as part of development cost is based on the fact that preproduction helicopters cannot be considered to represent fully developed prototypes of satisfactory production items unless they are built on production tools. First preproduction helicopter would not be built on production tooling, but this equipment should be essentially fully developed by the time the last preproduction machine is produced.

Number of preproduction helicopters was determined in the course of the Hiller study on the basis of observation of previous programs. Nichols concluded that on the basis of planned procurement of 1,000 helicopters, then approximately 12 test aircraft would be required. This would be the case in procurement of a completely new design.

Over-all development costs for the

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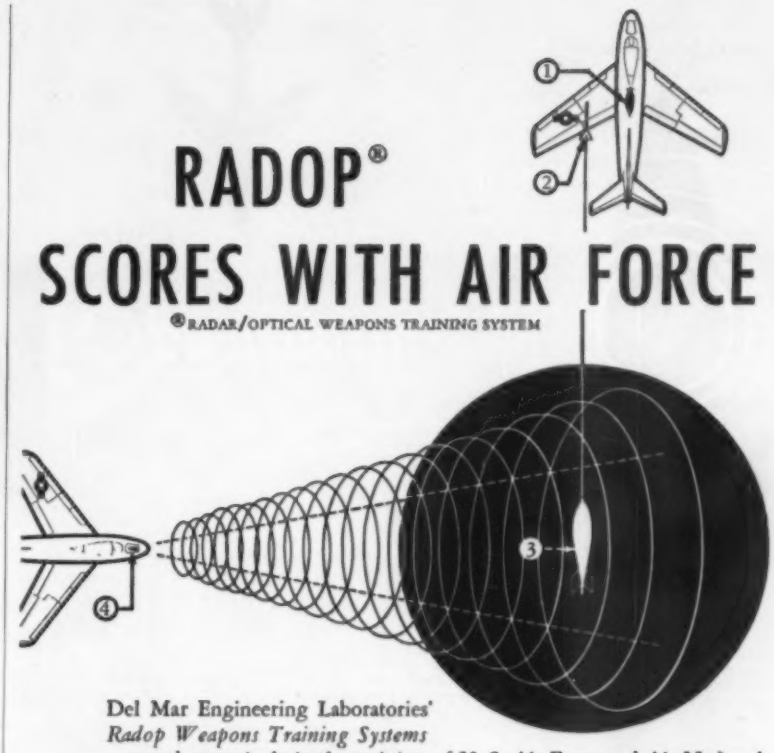

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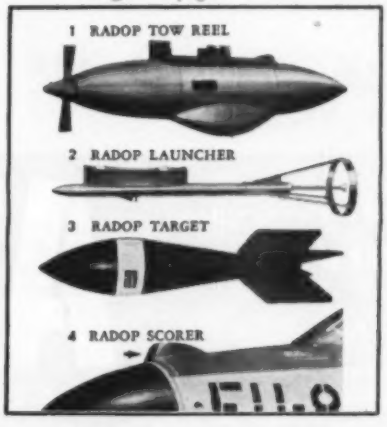

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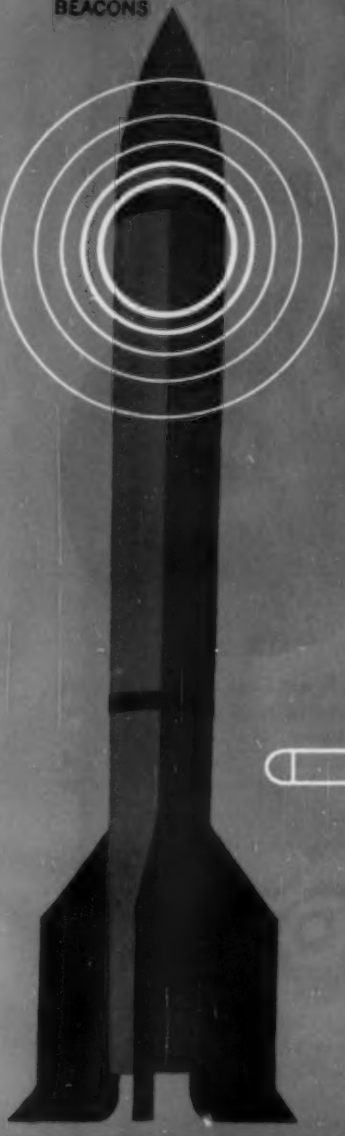

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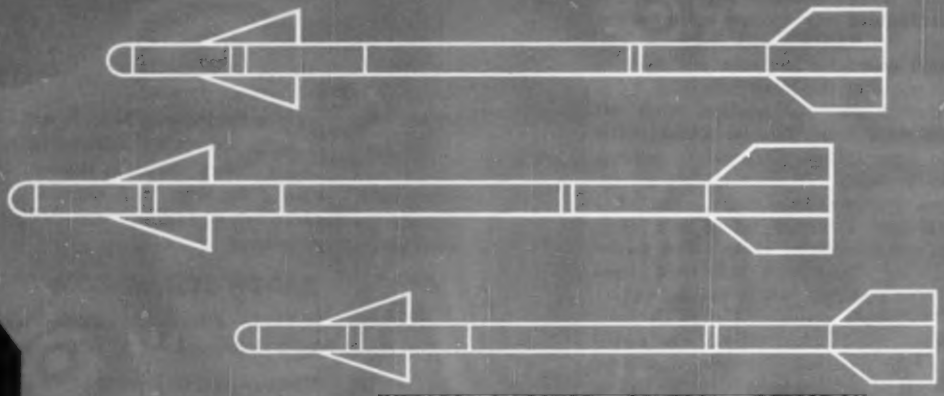

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varied configurations studied by Hiller showed that engineering costs varied from $2.599 million to $2.7 million; tooling varied from $.804 to $1,174 million; preproduction helicopter costs (based on 500 total production at 20 per month) varied from $1.13 to $1.500 million—total variation being from $4.533 million to $5.208 million.

But the engineer pointed out that development cost cannot be the criteria for a cheap helicopter since one should expect to increase his cost (including tooling) to attain lower production costs. Certain incongruities were presented during the study. Hiller engineering groups had taken particular pains to design aircraft of as wide a variety and complexity as possible within the specifications, but the manufacturing and cost estimates did not reflect these differentials to anywhere near the same degree.

For example, one design with a highly simplified rotor system and structure appeared to cost almost as much as a design with a more sophisticated rotor and structure.

In reviewing this situation, Hiller engineers found that the supposedly complicated rotor system above the swash plate cost less than the relatively simple controls below the swash plate.

The reason: the rotor is a bench assembly of expensive components; the controls, composed of relatively cheap control sticks, cables, push-pull rods, and bell cranks are installed, adjusted, aligned on the production line piece by piece.

Use of heavier, but cheaper components does not markedly affect helicopter costs, according to Nichols, since other more expensive components must also grow to provide the capacity to carry the cheaper components.

Effect of production rate on cost is very marked at low production rates, but unlike production quantity in which learning occurs indefinitely, cost flattens out at the higher rates for most of the components considered. There appears to be no price advantage in exceeding some 30 aircraft per month even up to a quantity of 1,200 helicopters, he reported. With very large quantities, the price decrease is due primarily to quantity, not rate, Nichols noted, considering a compatibility must exist between rate and quantity.

Hiller determined production costs for each of its two-place designs on basis of production of up to 4,800 units at rates up to 80 per month. For a quantity of 500 aircraft at a rate of 20 per month, unit costs came out as: Type A, $32,300; Type AO, $36,000; Type AC, $28,300; Type AM, $33,000; Type M, $22,700; Type MO, $25,620; Type MC, $25,100; Type O, $29,600 and Type OC, $32,000.

Company noted that the cost target of $15,000 could only be approached by sacrificing operational suitability in a sub-minimum design. None of the designs would attain the Army target price of $15,000 unless there was a requirement for some 5,000 aircraft or reduction in the specifications.

North American Plans Trisonic Test Facility

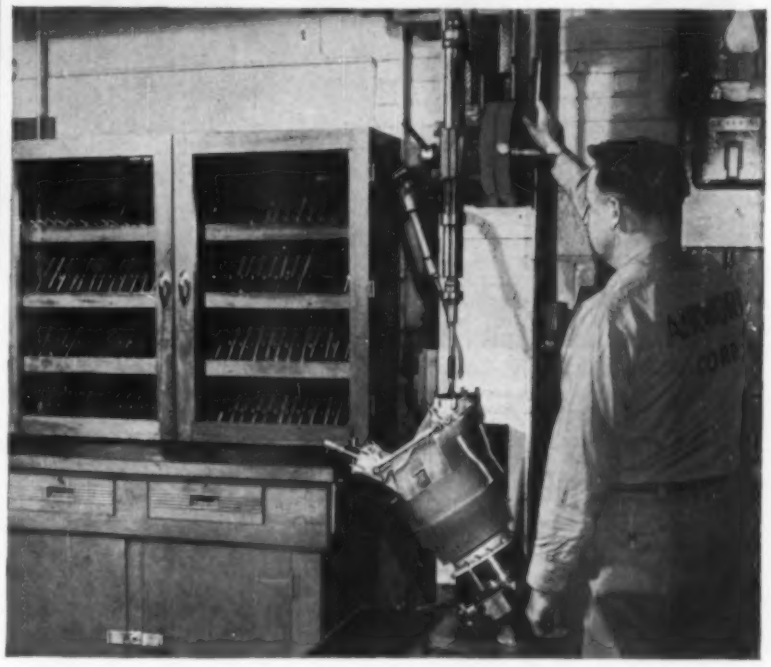
Los Angeles—Expansion of research and development facilities to test manned aircraft designed for triplesonic speed is planned by Los Angeles Division of North American Aviation Inc.

Company's new El Segundo Laboratories, to be completed and in operation by July, 1959, at a total cost of $8½ million, will house 113,000 sq. ft. of laboratory space and expanded facilities.

Included are structures, thermodynamics, chemical and general laboratories, as well as electronic impedance, radar and antenna powers.

First phase of construction program was completed last year with occupancy and full scale operation of $5 million trisonic wind tunnel.

The wind tunnel will be further expanded by approximately 4,000 sq. ft. before July 1.



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Dirty smears on the wing . . . oil drips on the hangar floor. Looks bad! Most of it *could* have been prevented at overhaul.

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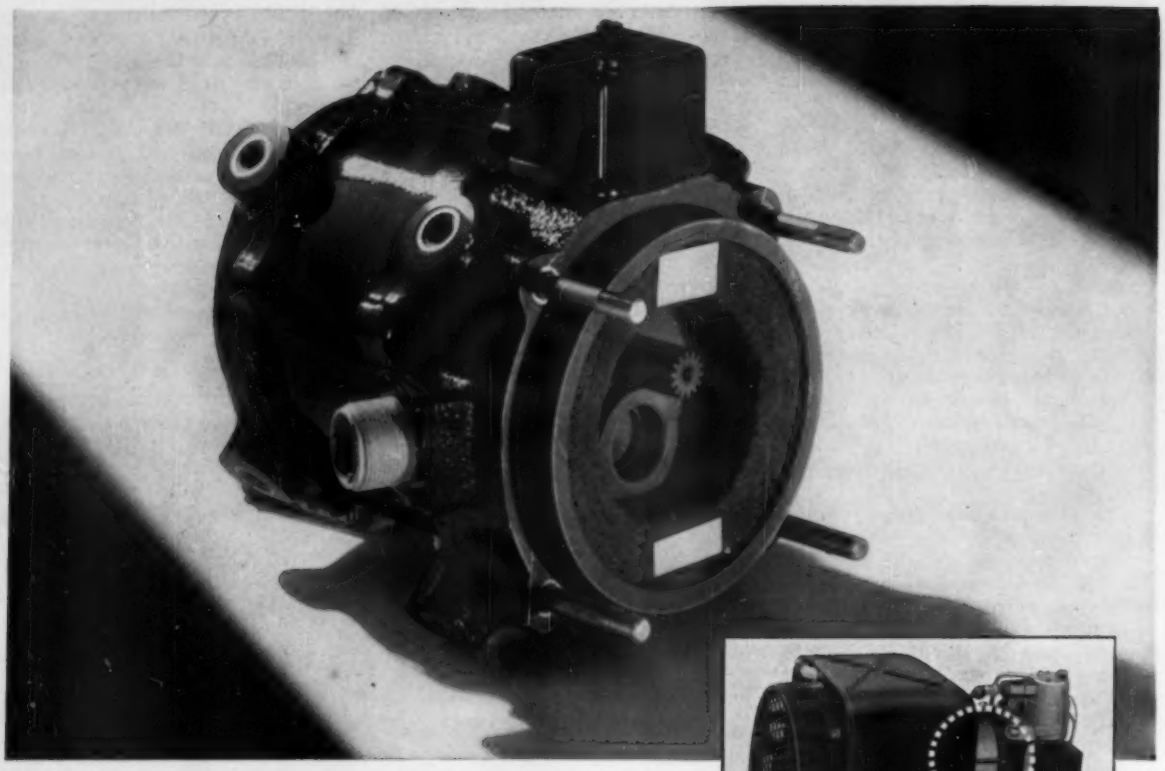

Model E6440-1 exemplifies Airborne capabilities in the design and development of large special motors. Inset shows application on Walter Kidde & Company lightweight compressor package (2.4 scfm, 3000 psi) used for auxiliary pneumatic power on jet tanker.

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Photo courtesy Walter Kidde & Company, Inc.

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3. Duty cycle: 30 min. on at full load/30 min. off
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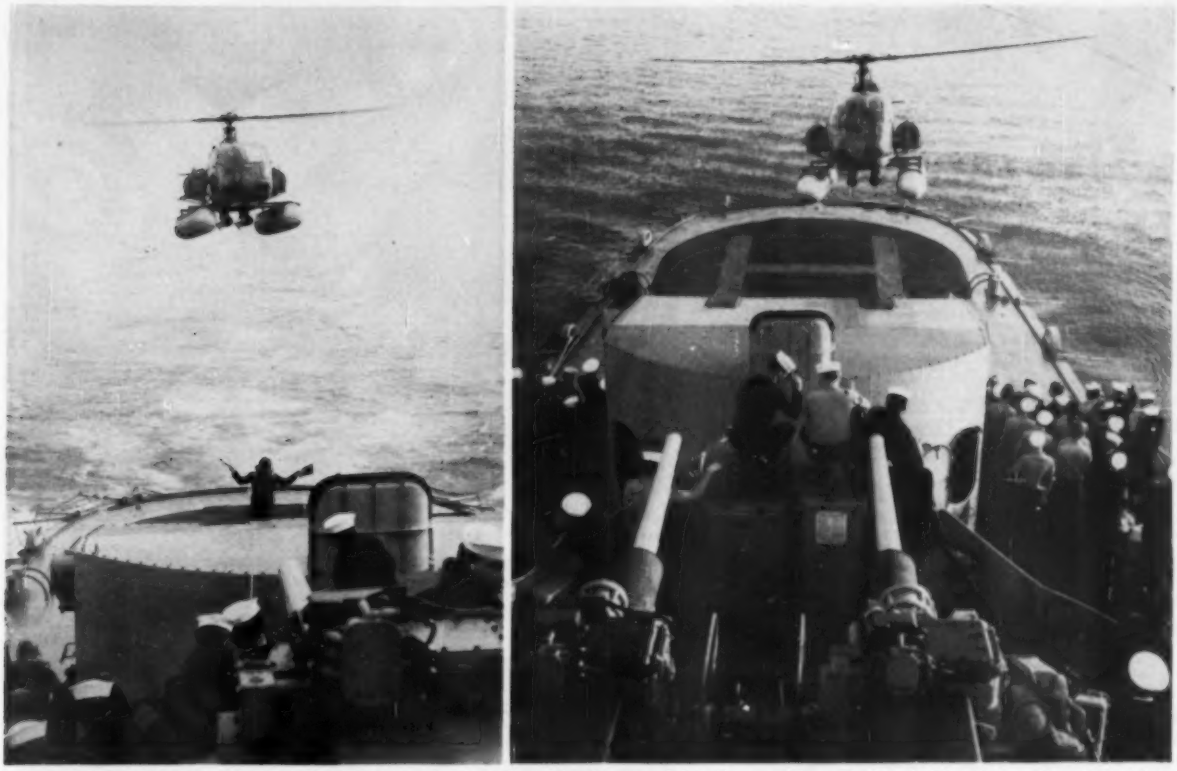


ACOUSTIC-SEEKING torpedoes are slung between floats of Republic Alouette (left), shown taking off; aircraft is landing on fantail at right.

Alouette Demonstrates ASW Capability

By William S. Reed

Aboard USS Larson—Use of helicopters to bring Navy destroyer anti-submarine warfare kill potential up to sonar gear capability was demonstrated here in a series of open-sea trials. Project DASH, for Destroyer Anti-Submarine Helicopter, conceived by the Navy as an interim measure pending development of advanced anti-submarine warfare (ASW) systems, brings the additional dividend of extending the useful life of a World War II vintage destroyer fleet.

Destroyers always have had to "run over" submarines to drop depth charges or torpedoes. Newer, faster submarines with increased underwater speed can evade attack even though destroyer sonar range is greatly increased.

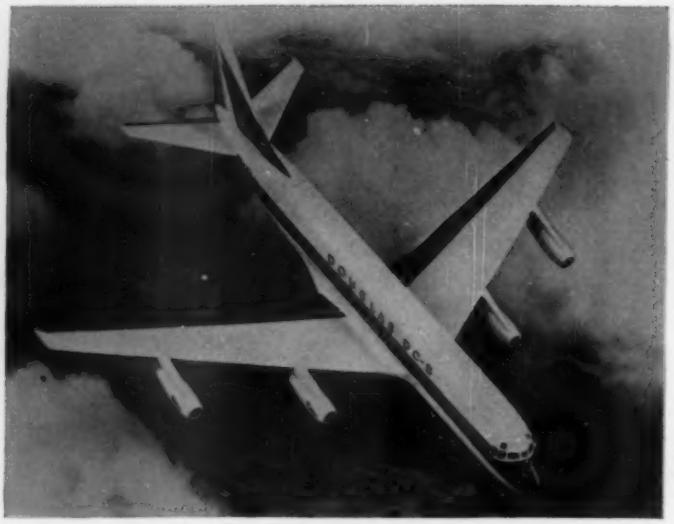
Employed as DASH, Republic Aviation Corp.'s Sud Alouette II (AW Sept. 1, p. 18) scrambles from the fantail of a destroyer in pursuit of a submarine anywhere within sonar range. Detection of the helicopter by a deep-running submarine is virtually impossible; enemy sub skipper's first indication of attack would be the explosion of an acoustic-seeking torpedo against the hull.

Destroyers can be converted to

CERTIFIED for diesel fuel operation, Alouette II is fueled by hydrant from ship's bunkers.

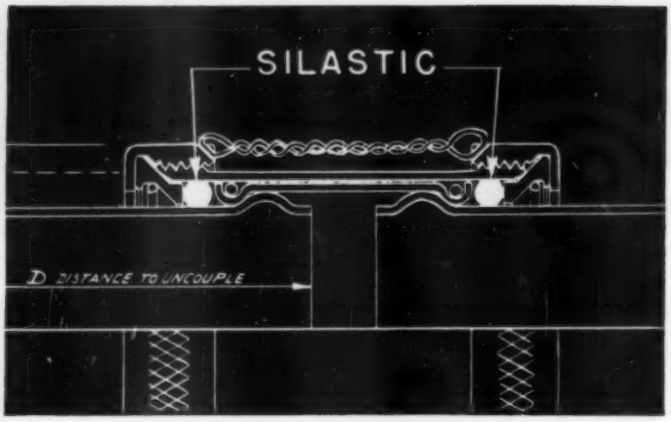
The PLANE

New Douglas DC-8 Jetliner, soon to enter commercial service with 18 of the world's leading airlines. The four-jet DC-8 cruises at 560 to 590 mph, carries 118 to 176 passengers, and will cross the Atlantic non-stop from New York to Paris in just over six hours. Fuel capacity on international flights exceeds 21 thousand gallons.



The PROBLEM

Coupling and sealing hundreds of joints in the DC-8's fuel lines. These couplings must be flexible and leakproof. On Mark Couplings, Incorporated, Los Angeles, the coupling designer, prevents leakage with rubber O-rings. For these O-rings, Douglas tested standard rubbery materials for fuel resistance, thermal stability, resistance to abrasion, weathering, compression set, and shrinkage after fluid immersion and dry out.



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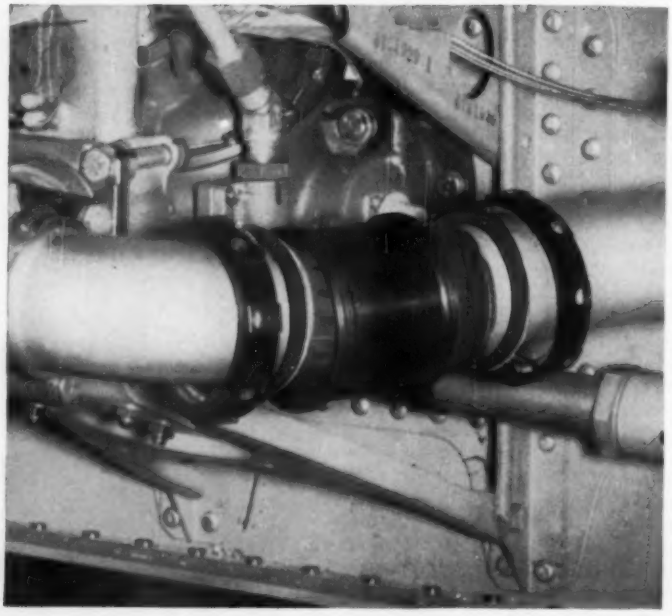

DASH capability in 48 hr., according to the Navy, and already carry the necessary sonar gear for submarine detection, and radio and radar gear necessary to direct the helicopter. Attaching tie-down cables to the deck and modifying the fantail guard rail so that it folds is about all that is required. The Alouette has been FAA-certificated to operate its Turbomeca Artouste II-B1 turbine engine on the same diesel fuel used by the destroyer engines, according to Republic, making it unnecessary to carry any extra jet fuel bunker on the ship.

Capability of the destroyer-helicopter combination was demonstrated off Long Beach, Calif. USS Larson steamed at 25 kt. About two minutes after sonar contact was established the Alouette was airborne with two acoustic-seeking torpedoes slung between its floats. Directed to the vicinity of an "enemy" sub by ship's radar, the helicopter pilot was given the drop command by radio. After the torpedo drop, the Alouette laid a smoke screen produced by pumping chemicals directly into the tail pipe. New emphasis may be given smoke screens following tests by Navy involving introduction of agents into smoke which make it opaque to radar.

The Alouette returned to the destroyer where rearming and refueling took about two minutes. Range of the turbine-powered aircraft, with a 570-lb. load, is in the vicinity of 75 naut. mi.

REPUBLIC Alouette's smoke-laying capability is attained by pumping chemicals directly into the tailpipe. Navy is testing materials to make the smoke opaque to radar.

Technique in operating the Alouette from a destroyer fantail is not beyond the average pilot's capability, according to Republic test pilot Tom Mason. Virtually instantaneous vertical response of the turbine-powered helicopter makes landings on the fantail easy.

The ultimate in DASH would be a drone-type helicopter. Some estimates of the weight required for droning run as little as 100 lb. Significance beyond the increase in payload, decrease in size, and the expendability of such a drone would be complete all-weather capability.

Republic also demonstrated the Sud Djinn, a helicopter considerably smaller than the Alouette. Unlike Alouette, which has its rotor geared to the turbine, Djinn expands the exhaust from its Turbomeca Palouste IV into the rotor hub and out through hollow blades to tip exhausts. Djinn actually can lift a payload approximately equal to its own 800-lb. weight, according to Republic, and has a surprisingly rapid jump-off rate.

NEW **ON MARK** FLEXIBLE LINE COUPLINGS FOR DC-8

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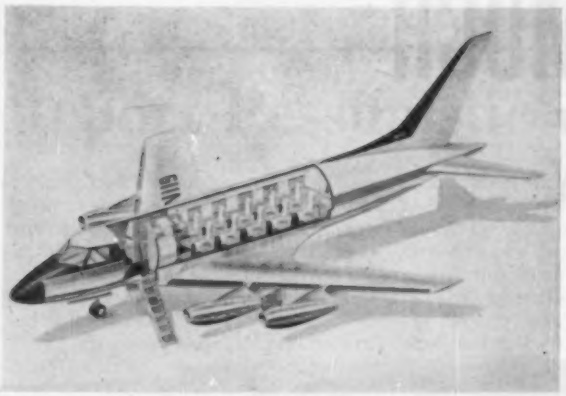
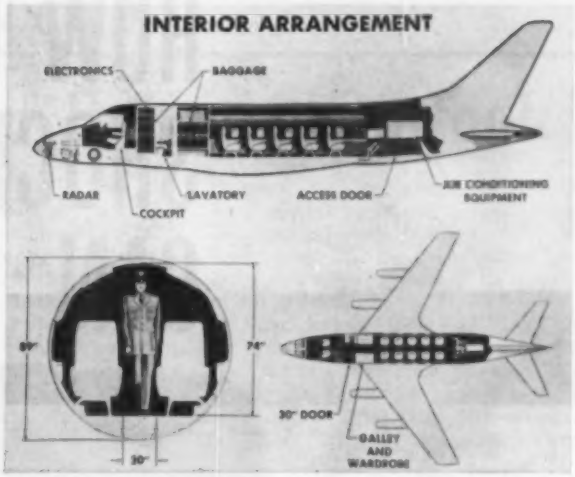
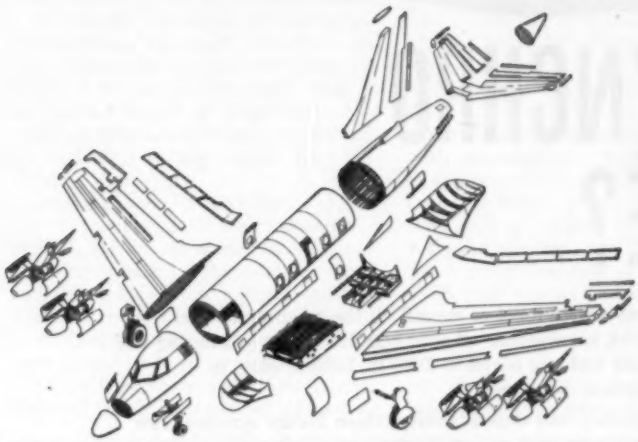
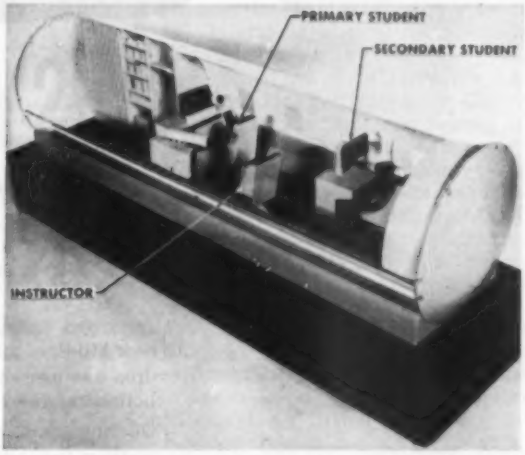




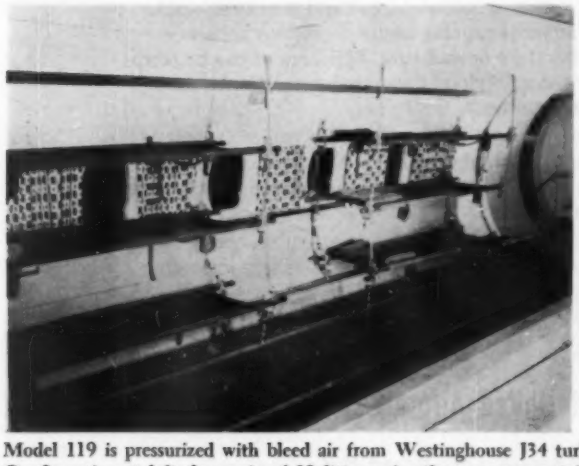
Cutaways of McDonnell Model 119 turbojet utility transport show seats for 10 passengers in both forward and rear-facing configuration. Floor to ceiling height is 74 in.

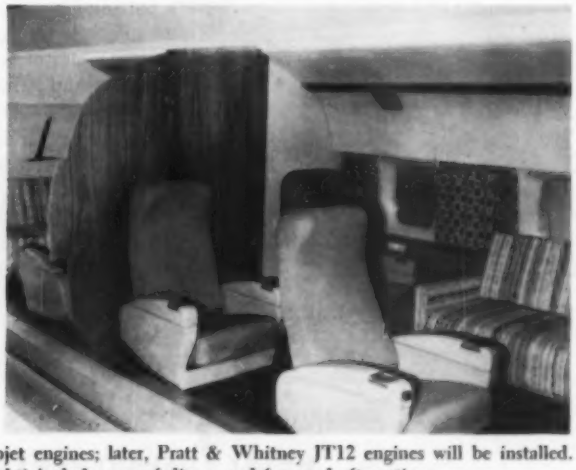
McDonnell 119 Has Varied Cabin Configurations





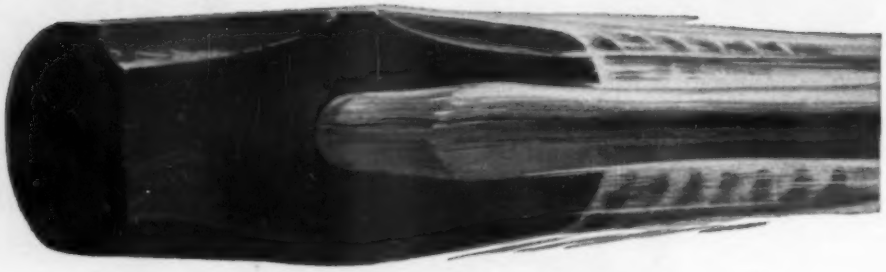
Exploded view of McDonnell 119 entry in U. S. Air Force UCX competition (AW Feb. 9, p. 32) emphasizes wide use of multiple load paths to produce structural safety in fail-safe design. Fuselage rings are 20 in. apart and stringers are 6 in. apart; crack stopping design halts cracks when they reach first piece of structure. View at right shows arrangement for radar operator training aircraft.





Model 119 is pressurized with bleed air from Westinghouse J34 turbojet engines; later, Pratt & Whitney JT12 engines will be installed. Configuration at left shows six of 12 litters. Another arrangement (right) includes use of divans and fore and aft seating.

HOW MUCH SHOCK CAN



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Report Pessimistic on Industry Outlook

New York—Pessimism plays a pronounced note in the 1959 outlook for airlines and aviation manufacturers contained in National Aviation Corp.'s annual report. The portfolio of this investment company is primarily aviation and airline securities.

After criticizing the Civil Aeronautics Board for acting too slowly in the fare increase crisis and the airlines for their lack of unanimity, the report adds:

"The best that it seems logical to look for in 1959 is enough recovery in its (the airline industry's) standing in the capital market so that its equity base can be broadened without further dilution of the kind which some of the trunks were forced to impose on their stockholders just to stay alive."

Noting the fourth quarter rise in airline earnings, the report also points out these looked better than they were because of the strike situation. Still, it considers evidence of a resumption of traffic growth a heartening sign through no indication of "easy street" for 1959-1960.

"Having been denied the opportunity to put fat on its bones during the 1950s," the report said, "the re-equipment revolution of the next few years and the added capacity which must be sold represent a gigantic undertaking in relation to a credit structure that has been stretched to its utmost limits."

Though pessimistic to this degree, National on the balance did increase its airline holdings last year in line with a trend that has generally been followed by professional investors (AW Oct. 6, p. 49; Jan. 26, p. 47). To some extent this trend may have been influenced by technical factors—buying on the theory that what has come down also must go back up—but a report from Bache & Co. issued about the same time as National Aviation Corp.'s summary gives a good insight on how the market analyzes the situation.

Jet financing problems and reduced earnings a year ago depressed airline stock prices. Recovery has been substantial since then, but the Bache report notes that prices are still well below former price-earnings ratios, reflecting investor dissatisfaction with airline stocks, and thus may still be selling at low prices in relation to potential earnings power.

The report cites these favorable factors:

• **Traffic growth** apparently will resume with introduction of new equipment and recovery from the recession. However, the Bache report considered tapping of new markets vital.

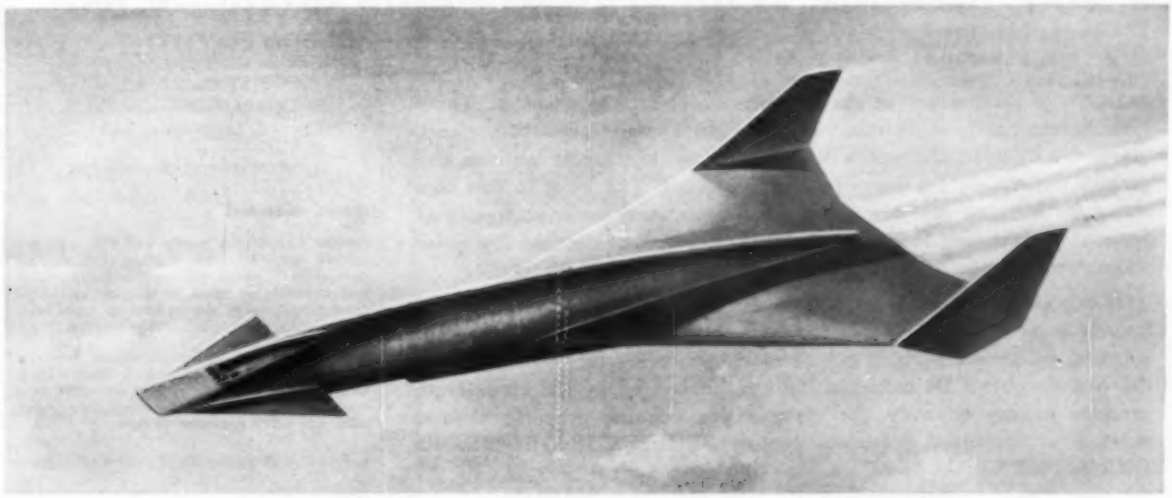
• **Equity dilution,** the threat of which was a major deterrent to stock prices in 1958, was not as severe as feared because of unexpected leniency on the part of institutions in arranging debt financing (AW Dec. 15, p. 37). Dilution is still a threat for some carriers, heavy debt commitments may handicap earnings, and severe restrictions have been placed on working capital and dividend payments in many cases, the report said. But the re-equipment program was termed essential for growth of the industry.

• **"More lenient"** policy of the Civil Aeronautics Board in allowing a general fare increase, reduction of some discounts and jet surcharges may indicate a significant shift from the previous CAB stand that no case has been made for a rate increase.

The report recommended United Air Lines, Delta Air Lines and Continental Air Lines, the latter as a highly speculative situation but with considerable potential. Several others appeared attractive, the report said, naming American, Northwest, Capital (as a speculation on further rate increases) and Western. Trans World Airlines may be forced into further equity dilution as its financing plans mature, the report said, and National, Eastern and Northeast are facing problems of intense competition along similar routes.

Fortunes of the four manufacturers—Boeing, Douglas, Convair and Lockheed—who are building the U.S. turbine transports for the major trunks are bound up in this situation.

"As matters stand today," the report said, "not one of the four builders has enough orders in hand to recover what has been invested in the design, development and testing of its first jet



Convair Envisions Mach 3-5 Supersonic Transport

Artist's conception of a Mach 3-5 supersonic passenger transport was prepared by Convair Division of General Dynamics Corp. Aircraft would cruise at altitudes of 60,000 ft. or higher, according to design report by R. C. Sebold, Convair vice president (AW Feb. 2, p. 38).

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airliner. Their combined investment in just this phase is on the order of $500 million and has been written off as made.

"However, to retrieve it in full solely as a commercial venture, a high degree of ingenuity will be called for and the radical step of accepting some trade-ins is an example."

Despite their reluctance to enter the area as principals in the disposal of excess equipment, the report said these manufacturers have recognized that a collapse in the used plane market would stifle jet sales and have bowed to such radical steps as trade-ins.

The report criticized the Administration for its complacency in the missile and space field in face of Russian competition. Placing a ceiling on defense spending when there is a question of its adequacy is a calculated risk that need not be taken, the report asserted.

Favorable developments mentioned in the report included:

- **Establishment** of the Federal Aviation Agency.
- **Issuance of the Cherington report,** bringing into focus publicly the problems of the airlines.
- **Continued strength** of the business flying field.

Changes in the corporation's portfolio last year included:

- **Eliminated:** Bendix Aviation Corp.; KLM Royal Dutch Airlines; Northeast Airlines.
- **Added for first time:** Ampex Corp.; Grumman; Hewlett-Packard; Hoffman Electronics Corp; Lockheed Aircraft Corp; Statham Instruments; Thiokol; Varian Associates, Northwest Airlines.
- **Increased previous holdings:** Aerojet-General; Marquardt; North American Aviation, and American, Braniff, United and Western Air Lines.
- **Decreased previous holdings:** Boeing (offset by purchase of Boeing convertible debentures); Cessna; Chance Vought; Douglas; General Dynamics; Martin; Thompson Ramo Wooldridge; United Aircraft; Pan American.

Market value of the total portfolio was given at $22,459,572 compared with an average cost of $15,775,243.

Manned Plane Need Remains, Peale Says

New York—United States air defense philosophy is moving toward a "mixed" Air Force which will combine manned aircraft supplemented by missiles, according to Mundy I. Peale, president of Republic Aviation Corp.

He said he "wouldn't want to hazard a guess" on the proportions of manned aircraft to missiles, but he emphasized to the New York Society of Security Analysts here last week that "there will always be need for manned airborne

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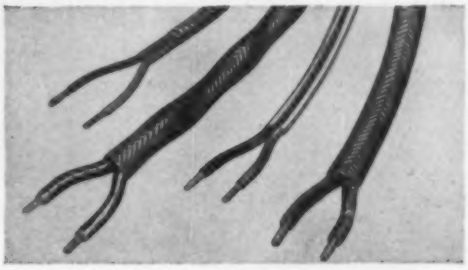

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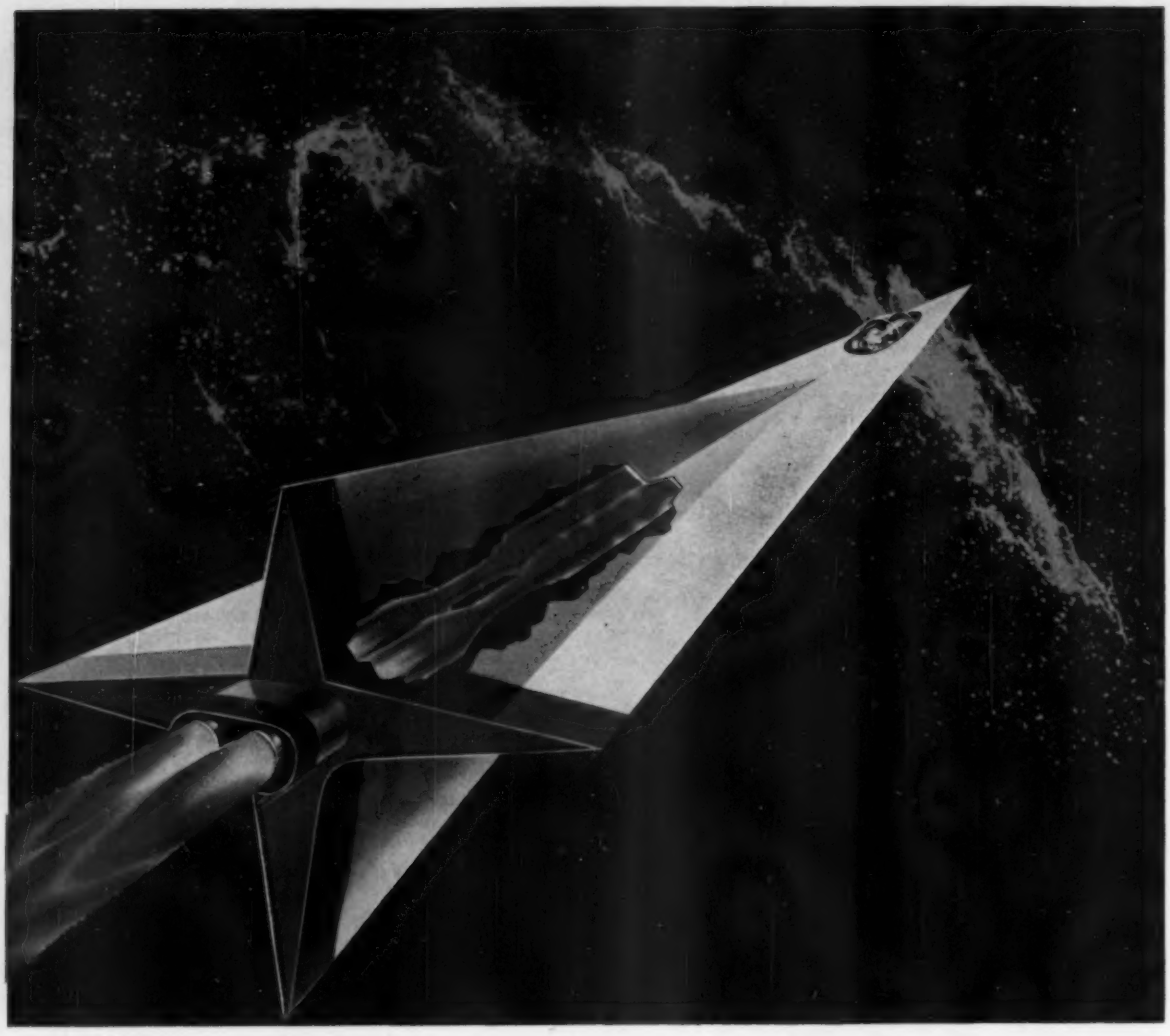

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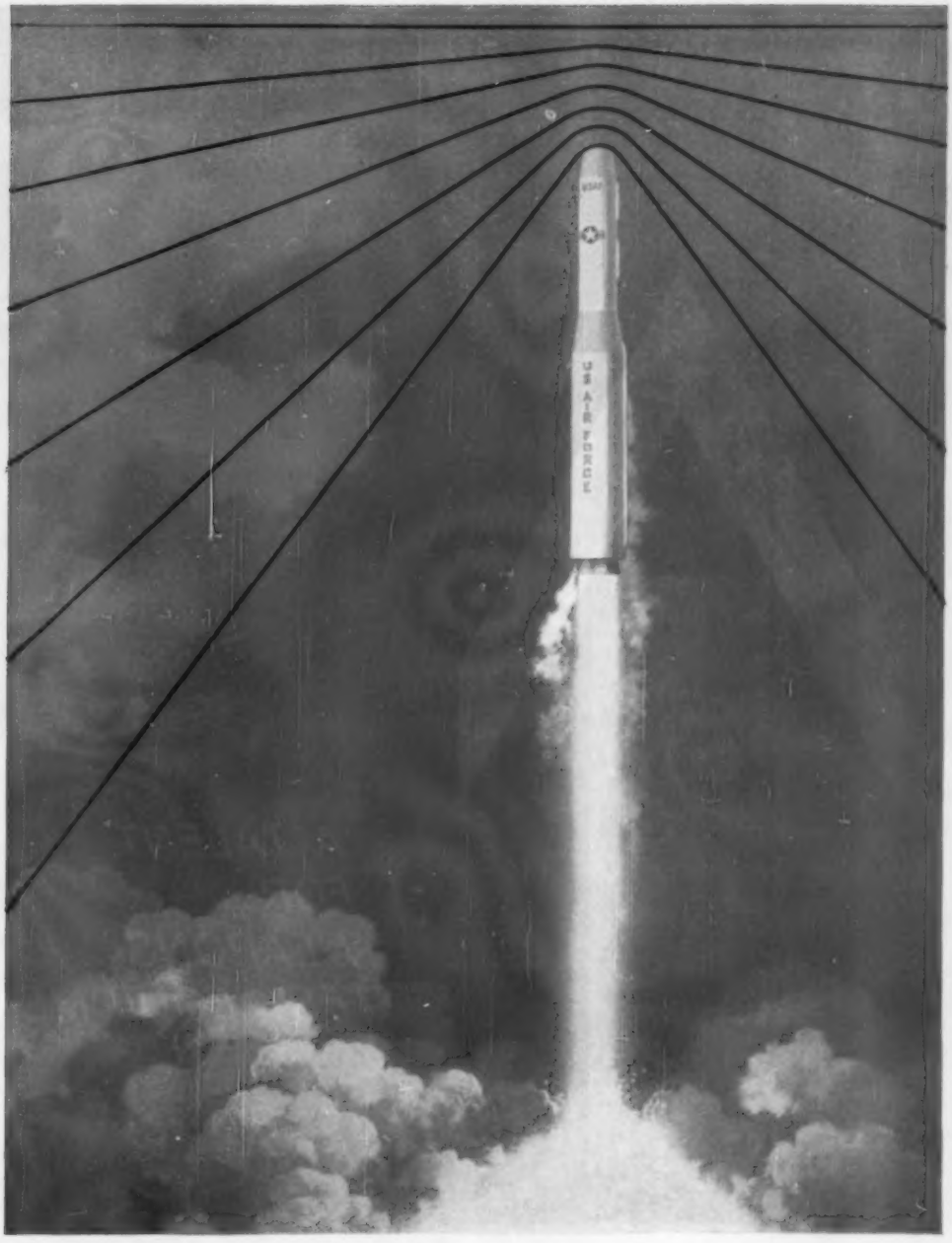

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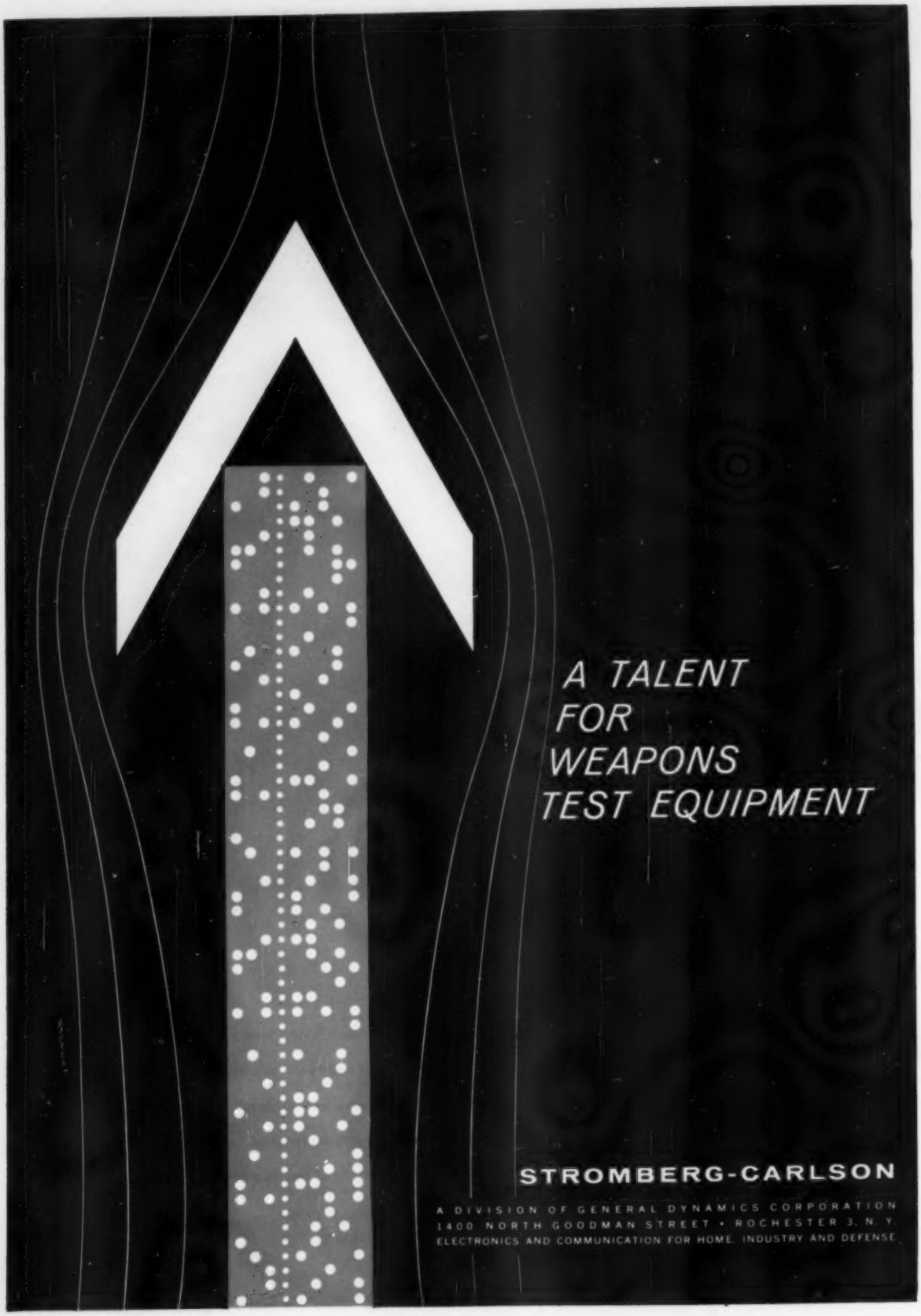
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vehicles, whether they be aircraft or space vehicles."

Peale noted that in developing missiles, "we must remember that we face the incredibly difficult job of trying to duplicate the human skills of a pilot with mechanical, electronic and other control devices. In my opinion, we will never completely do this."

Peale also cited the rising cost of aircraft compared with the "enormous" cost of missiles. He claimed that, in production quantities, one intercontinental ballistic missile wing may cost $1 billion.

Discussing Republic's financial picture, Peale said the company has a current backlog of $42,019,000 and said indications now are that Republic will later negotiate contracts to carry production through 1962. Republic F-105 Thunderchief jet interceptor is programed for production through 1962.

He estimated Republic sales for 1958 will be about $203 million; net income, based on preliminary figures, will be about $5 million, with earnings per share about $3.39, against $4.15 in 1957. Peale predicted that in 1959, although productivity will increase, sales will be lower, explaining that this is due to "accounting treatment given to different type contracts."

The company will move from a cost plus fixed fee to a fixed price basis, recording sales and earnings only upon physical delivery of aircraft, as contrasted with progress bills and reimbursements made on cost plus fixed fee contracts.

Republic's working capital at the end of 1958 fiscal year is about $36,038,000, or the equivalent of $24.48 a share, marking a hike of some $1,138,000 in working capital during the year.

Defining the F-105 as "the most versatile weapon system ever devised," Peale said the airplane is constantly being changed and improved to improve design . . . "pushing obsolescence further into the future." He continued:

"When we reach that inevitable point-of-no-return, we have plans for second and third generation F-105s . . . radical new models like twin-engine STOL and VTOL versions, a strike recon version, a multipurpose export version for the NATO countries."

Turning to Republic's diversification program, Peale said the Missile Division should show about $6.4 million in sales for Fiscal 1958, a year in which it doubled its business. He pointed out that the division this year will build experimental versions of the Swallow supersonic drone, in addition to service test production work on the SD-3 propeller driven drone.

Republic, he said, also has undertaken comprehensive study of an anti-ICBM missile and an anti-satellite mis-

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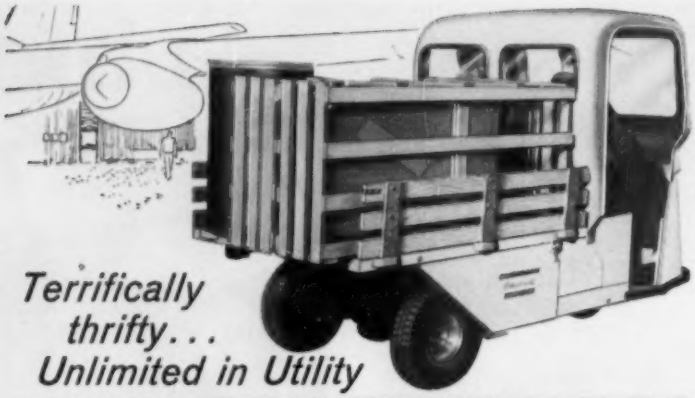

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sile, along with other sophisticated projects.

In the helicopter field, sales of the Sud Alouette II are "not easily come by," Peale mentioned. The difficulty is not with the product, he explained, but in the tight financing position of operators. Republic is taking "a long, serious look" at the Sud Model 3200 triple-turbine helicopter (AW Dec. 29, p. 25) which Peale said has potential for local transportation and commuter service operations.

In the research and development field, which has $35 million earmarked for Republic's varied programs, between $8-10 million will be spent this year, mostly in construction and outfitting of the new Engineering Research & Development Center on Long Island.

Peale said, in reference to Republic's R&D and space technology efforts, "unfortunately there seems to be an impression that this was a sudden do-or-die decision on our part." Generally, he said, the program simply reflects long standing company policy of "keeping on top of rapidly changing technology."

Projects include:

- **Studies on practicality** of establishing a manned observation post on the moon.
- **Complex formula** for determining proper trajectory for a lunar probe which has been worked out by Republic scientists.
- **Study programs on hot oils,** magneto-hydrodynamics, and protective coatings to withstand Mach 5 re-entry temperatures.
- **Proposals for a manned hypersonic** bomber for Strategic Air Command.

Republic, Peale noted, also has done considerable development work on strategic orbital re-entry vehicles for the period between 1960-70; an earth orbiting boost-glide weapons system, plus a proposal to put a man in space and return him safely.

AMC Contracts

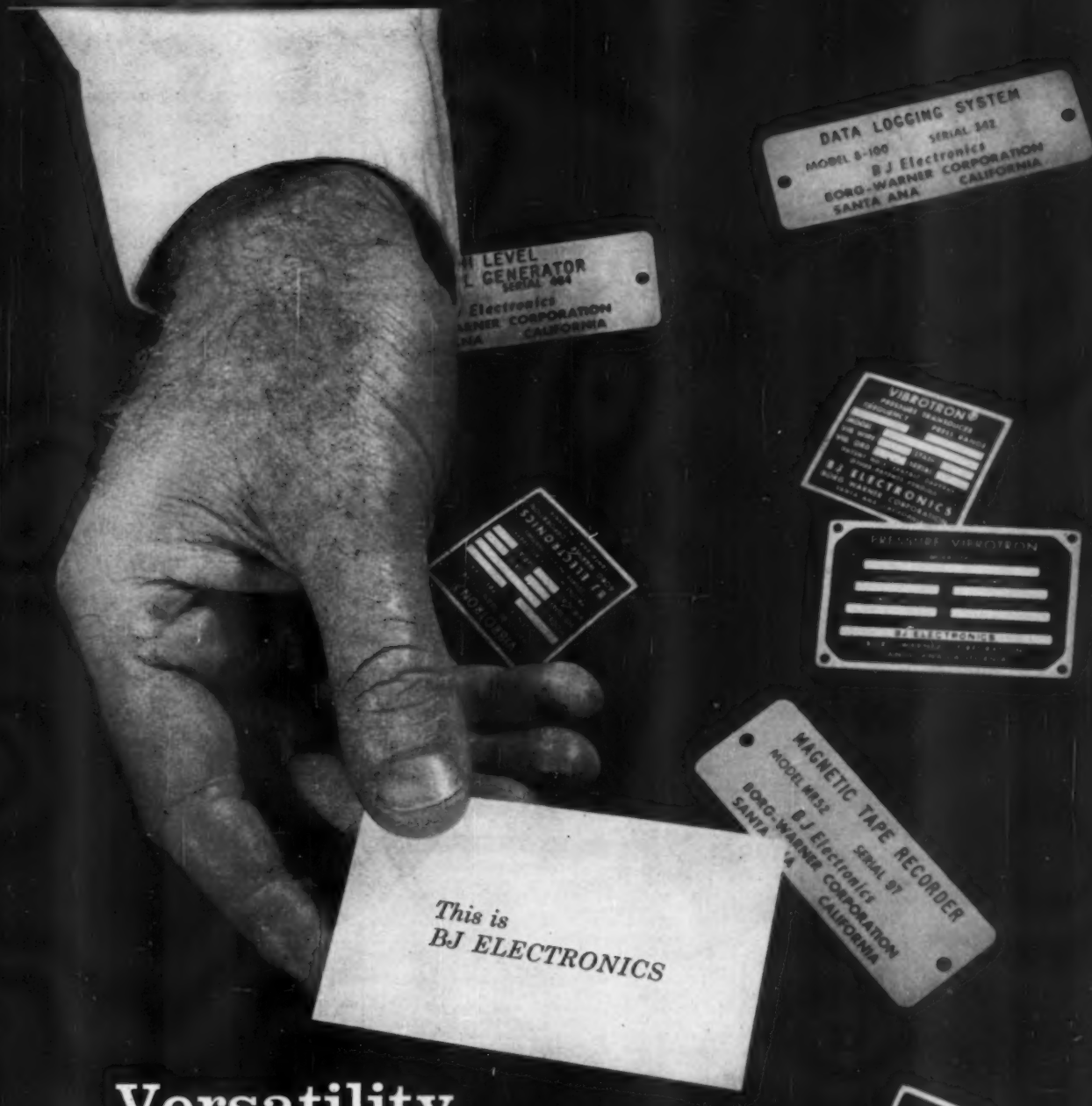
Wright-Patterson AFB—Ohio: Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

Tube Division, Radio Corp. of America, Harrison, N. J., procurement of research and development of methods and techniques for manufacturing high sensitivity photomultiplier tubes, (PR XL-8-1410-7268), $36,929.

Republic Aviation Corp., Farmingdale, N. Y., materials, services and equipment necessary to bring the XF-103 program to an orderly conclusion and to provide future manufacturing development methods for titanium and high-temperature steels. (PR PB-8-MMP-6301), $272,311.

Sylvania Electric Products, Inc., Emporium, Pa., improvement of the design, repeatibility and producibility of the 8N-2146C tube for the purpose of establishing a firm specification, (PR PB-8-MMP-6234 and amendment no. 1), $136,295.

Crucible Steel Co. of America, Midland, Pa., development of methods and machinery for cold rolling titanium and titanium alloy to close thickness tolerances of less than



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±2½% with a flatness of 1% or less using material which has a width greater than 48 in., (PR PB-8-MMP-6204), $53,990.

Crucible Steel Co. of America, Midland, Pa., development of methods and techniques for rolling titanium alloys reduced to an acceptable minimum differential between longitudinal and transverse properties capable of forming final aircraft components, (PR PB-8-MMP-6199), $94,296.

Crucible Steel Co. of America, Midland, Pa., development of methods for consistently producing .010 to .100 in. thick titanium alloy sheet with a flatness of 1% or less, (PR PB-8-MMP-6201), $121,000.

Westinghouse Electric Corp., Dayton, Ohio, high temperature silicon switching device, (PR 08738), $69,427.

Westinghouse Electric Corp., Dayton, Ohio, miniaturized power transformers, (PR PB-8-MMP-6634-1), $170,552.

Research, Inc., Hopkins, Minn., arresting cable, pop-up device for engaging jet aircraft, (PR 08582), $193,921.

Eitel-McCullough, Inc., San Bruno, Calif., construction of CD-16 and CD-18 tubes for environmental testing and statistical evaluation, (PR PB-8-MMP-6275), $946,743.

North American Aviation, Inc., Los Angeles, structural analysis and flutter analysis reports, (PR 14470), $120,205.

Doehler-Jarvis Division, National Lead Co., Toledo, Ohio, investigation of the effect of ultra high pressure exerted on castings during and prior to solidification, (PR PB-8-MMP-6153), $46,776.

Pioneer Parachute Co., Manchester, Conn., canopies and accessory hardware for experimental parachute systems for use with classified items, (PR 56438), $39,866.

Systems Research Laboratories, Inc., Dayton, Ohio, development of high temperature radiation-resistant thermometers, (PR PB-8-MMP-5699), $51,335.

Pioneer-Central Division, Bendix Aviation Corp., Davenport, Iowa, survival kit assemblies for service test, (PR DG-9-01A-7215 and 57125), $30,000.

Dynamic Research, Inc., Los Angeles, development, fabrication and evaluation of a service test quantity of two recharging units, liquid nitrogen or oxygen, including supporting spare parts for three months operations, (PR MG-8-4310-316 and amendment no. 1), $86,479.

Standard Steel Works, Inc., Kansas City, Mo., type MH-1 compressed gas cylinder semitrailer in accordance with MIL-S-4972 and spare parts for storage, transportation and handling of various compressed gases, (PR MP-9-2330-30115), $696,296.

John I. Thompson & Co., Washington, D. C., storing and distribution of Air Force forms and publications, (PR CG-9-P-1007), $300,000.

The American Coleman Co., Littleton, Colo., one vehicle, aircraft movement, unconventional type, up to 500,000 lb. gross weight for B-52 aircraft with supporting data, (RFQ 33-600-59-5002), (PR MP-9-2420-30105), $57,508.

International Electronics Engineering, Inc., Washington, D. C., maintenance services for data reduction and specialized intelligence equipment. (PR ATI-59-LP-19), $50,343.

Fay, Spoffard and Thorndike, Inc., Boston, title II architect-engineer inspection services, (PR PM-8-X-5618, 5623 and 5622), $26,370.

Laboratory for Electronics, Inc., Boston, five man years of engineering services to support AN/APN-105 Doppler radar program for F-105 aircraft, (PR PE-8-8T-3772), $135,889.

Morse Instrument Co., Hudson, Ohio, various replacement parts for C-1A & C-1B timer, A-13 & EL-1A dryer, A-8 & EH-7 processors and D-1, EN-1A, A-14A, A-18 and E-1 printers and ground support equipment, (PR MO-8-6740-2665, MO-8-10B-750, MO-8-6760-2543, MO-8-6760-2595 and MO-8-6760-2602), $49,069.

Waste King Corp., Los Angeles, type MA-1 supersonic pitot tube for F-101 and F-104 aircraft, (PR PE-7-05C-3696 and -4016), $84,578.

Propeller Division, Curtiss-Wright Corp., Caldwell, N. J., propeller assemblies and components for C-133B aircraft, spare parts and data, (PR PE-8-03A-3743 and 4015), $3,051,747.

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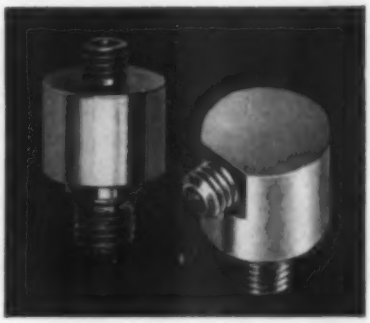

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State Department Report on C-130 Crash in Russia:

U.S. Monitors

(U. S. State Department after several months investigation has formally charged that Soviet interceptors attacked and shot down a U. S. Air Force Lockheed C-130 last Sept. 2. The Department says the unarmed aircraft, which crashed inside the Soviet border, was attacked on the Turkish side of the border while taking part "in a world-wide Air Force project to study the propagation of radio waves transmitted by U. S. radio stations." All 17 crewmembers aboard the aircraft are believed to have been killed. The Soviet government has conceded that the C-130 crashed inside USSR territory but denies it was attacked by Russian planes. To back its claim that the C-130 was attacked and shot down, the State Department has released translations and photostats of two articles from Sovetskaya Aviatsyia, Russian Air Force daily newspaper, apparently describing the attack; what the department describes as a transcript of an intercepted radio conversation between the Soviet pilots who attacked the American plane; a chronology of its protests, and the Soviet replys. AVIATION WEEK is reprinting the articles and reports in full.)

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СОВЕТСКАЯ АВИАЦИЯ

ГАЗЕТА ВОЕННО-ВОЗДУШНЫХ СИЛ
ОРГАН МИНИСТЕРСТВА ОБОРОНЫ СОЮЗА ССР

ПЕРЕДОВЫЕ ЛЮДИ НАШЕЙ АВИАЦИИ

ВЫСОКОЕ МАСТЕРСТВО

1. Цель обнаружена...

За нашу Советскую Родину!

СОВЕТСКАЯ АВИАЦИЯ

ГАЗЕТА ВОЕННО-ВОЗДУШНЫХ СИЛ
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ПЕРЕДОВЫЕ ЛЮДИ НАШЕЙ АВИАЦИИ

ВЫСОКОЕ МАСТЕРСТВО

2. Стремительная атака

ARTICLES from Sovetskaya Aviatsyia, Russian Air Force Daily newspaper (reproduced in part above), contain what is apparently a description of the attack. The caption to the top photo reads—"Operator Junior Sergeant A. Gvozdev, Komsomol member rated excellent in combat and political training, is tracking the target." In the bottom photo of Russian airmen apparently working at a situation plotting board, the caption reads—"In the photograph (left to right) Navigator Captain N. Romanyuta, Plotters Privates D. Pankeev, N. Budarin, S. Ichin."

On Sept. 2, 1958, an unarmed United States Air Force C-130 transport aircraft disappeared while on a flight in Turkey. Seventeen men were aboard the plane.

As the result of an investigation conducted by the United States Air Force in Europe (USAFE), it was determined that the plane had been intercepted and attacked by Soviet fighter aircraft in the region of the Turkish-Soviet frontier near Kars, Turkey, following which it had crashed in flames in Soviet Armenia. On Sept. 24, 1958, the remains of six men were turned over to United States authorities.

Missing 11 Men

The U.S. government has repeatedly pressed the Soviet government for the return of the missing 11 members of the crew of this plane or for information regarding their condition and whereabouts. In its latest written communication on this subject, a note of Oct. 16, 1958, the Soviet government repeated its earlier denials that any further information was available regarding members of the crew of the plane.

On Nov. 13, 1958, Deputy Under Secretary of State Robert Murphy made a lengthy oral representation to Soviet Ambassador Mikhail A. Menshikov, presenting him with evidence that Soviet fighter planes had intercepted the C-130 and shot it down without regard to the rules of civilized international practice. Mr. Murphy said that the United States wished a settlement of this case. He emphasized that some of our men had been killed, that there were certain rules of conduct in the civilized world, and that the United States government hoped the desired information regarding the 11 missing men would be promptly forthcoming. The Soviet ambassador said that he would convey the details of this representation to his government. (A full account of Mr. Murphy's representation is included here.)

The Soviet government did not reply to this representation.

On Jan. 7, 1959, the Vice President of the United States received the First Deputy

Soviet Attack on Air Force Transport

Chairman of the Council of Ministers of the USSR., Mr. Anastas I. Mikoyan. During the course of their conversation, the Vice President raised the question of the 11 missing crew members of the C-130. Referring to the desirability of reducing tensions between the United States and the Soviet Union, the Vice President said it would be useful to make progress on matters like this one. He said it would be helpful if the Soviet government gave the United States government an indication or a statement about what had happened to the men involved. The Vice President said that the C-130 case has great emotional impact in the United States. Great concern is felt about this case by the American people.

Mr. Mikoyan replied that the Soviet government had given all the information it had. He said that there was no sense in their trying to hide anything and wondered why the Americans were so suspicious about this.

The Secretary took up with Mr. Mikoyan on Jan. 16, 1959, the destruction by Soviet planes of the unarmed C-130 and asked for information regarding the 11 missing crew members. He pointed out that response by the Soviet government to our representations would help to satisfy serious anxieties felt by the American people, who want the missing men returned, and that a meaningful response would be a helpful step from the standpoint of United States-Soviet relations.

Mr. Mikoyan said that the Soviet government had done all that it could, that all the bodies had been returned, and that the Soviet government did not know about any other personnel. Mr. Mikoyan protested that there would be no point in the Soviet government holding any bodies or living crewmen, and he expressed the Soviet government's lack of understanding and irritation over the U. S. government's insistence concerning this case. He denied that the plane had been shot down, asserting that it had crashed.

In view of the refusal of the Soviet government to respond satisfactorily to this government's representations on this case, the United States government reserves its rights with reference to the human and material losses incurred as a result of the Soviet action of Sept. 2, 1958.

The remains of six members of the crew of the C-130 were . . . returned to United States authorities on Sept. 24, 1958.

Murphy Presentation

On Nov. 13, 1958, Deputy Under Secretary of State Robert Murphy received Soviet Ambassador Mikhail A. Menshikov, who was accompanied by Maj. Gen. Mikhail N. Kostiouk, Air Attache of the Soviet Embassy at Washington.

Mr. Murphy recalled Ambassador Menshikov's past statements regarding his desire to promote improved U.S.-USSR relations and better understanding between the two countries. He then referred to the loss of the United States Air Force C-130 in Soviet Armenia on Sept. 2, 1958, as a cause of grave misunderstanding. He expressed the hope that the Ambassador would cooperate in removing this misunderstanding.

Mr. Murphy told the ambassador that it was difficult for the United States government to understand why the Soviet government had supplied no information regarding the crash until 10 days after the incident had occurred and then had furnished only a fragmentary report. Mr. Murphy reviewed the facts in the case and informed the ambassador that it appeared to the United States government that the American pilot, as a result of the signals transmitted by radio beacons in Soviet Georgia and Armenia, had probably made a navigational error which resulted in his unintentionally crossing the Soviet border. The plane, having thus flown into Soviet territory, had been shot down by Soviet fighter aircraft without regard to the rules of civilized international practice, as though it were an enemy aircraft. The tail assembly had been shot off and the plane had fallen out of control.

There had been 17 men in the plane, but the remains of only six men had been returned to the American authorities. Accordingly, the United States government was making this demarche to the Soviet government through Ambassador Menshikov for information in the possession of the Soviet government regarding the men who were still missing. Mr. Murphy said that he could not emphasize enough the gravity with which the United States government viewed this case. The United States government wanted the facts. It wanted to know what had happened to the men.

Since the ambassador had questioned Mr. Murphy's statement that the United States plane had been shot down by Soviet fighter aircraft, Mr. Murphy offered to have played for the ambassador a recording of the radio conversation between the Soviet pilots who had shot down the C-130. The ambassador declined to listen to this recording, saying that he was not competent to assess it from a technical point of view. Mr. Murphy explained that it was for that reason that the Soviet Air Attache, General Kostiouk, an aviation expert, had been invited to accompany the ambassador on his call. Mr. Murphy explained that the ambassador had been summoned in order that facts known to the United States government might be communicated to him as Soviet ambassador to the United States for conveyance to his government. Mr. Murphy said that it was Ambassador Menshikov's responsibility, as Soviet ambassador to the United States, to listen to the representations that were being made to him. The Soviet ambassador nonetheless refused to listen to the tape recording. Mr. Murphy then gave the ambassador a transcript in Russian of the recording.

Ambassador Menshikov stated that the Soviet government had replied to the notes addressed to it by the United States government on this matter and suggested that these replies represented all the information available to the Soviet government. Mr. Murphy replied that evidence in the possession of the United States government indicated that additional and very important information was available, and added that it was the intention of the United States government to pursue this case further. Mr. Murphy said that the United States government wished a settlement of this case. He emphasized that some of our men had been killed, that there were certain rules of conduct in the civilized world, and that the United States government hoped the desired information regarding the missing men would be promptly forthcoming.

Mr. Murphy then briefly reviewed the case once more, pointing out that the operation of Soviet radio beacons in the area might easily have induced a navigational error on the part of the pilot. He said that the plane had entered Soviet airspace in error, and not intentionally.

Mr. Murphy then read most of a translation of any article entitled "Great Skill: A Swift Attack," which had been published in Soviet Aviation, the newspaper of the Soviet Air Force, on Sept. 20, 1958. When he had concluded, the Soviet ambassador asked Mr. Murphy whether what had been read were fiction. Mr. Murphy then handed the ambassador photostatic copies of the article and a preceding one on the same subject. Mr. Murphy once more told the ambassador that the United States government regarded this case with extreme gravity. Ambassador Menshikov said that he would convey the details of this representation to his government.

Incident Chronology

• **Sept. 2:** An unarmed USAF C-130 transport aircraft, attached to the 7406th Support Squadron based at Rhine-Main Air Base, Frankfurt, Germany, disappears between Trabzon and Van, Turkey, while participating in a world-wide Air Force project to study the propagation of radio waves transmitted by United States radio stations. The plane was on a flight from Adana to Trabzon to Van and back to Adana, all within Turkey. Aboard the aircraft were:

Capt. Paul E. Duncan, Washington, D. C.

First Lt. John E. Simpson, Richland, Wash.

Capt. Rudy J. Swiestra, Compton, Calif.

First Lt. Ricardo M. Villarreal, Laredo, Texas.

Capt. Edward J. Jeruss, New Haven Conn.

Sgt. Leroy Price, Hodgeville, Ky.

Technical Sgt. Arthur L. Mello, Erie, Pa.

Master Sgt. George P. Petrochilos, Levittown, Pa.

Aircraftsman First Class Robert J. Oshinskie, Shamokin, Pa.

Aircraftsman Second Class James E. Ferguson, Jr., LaPorte, Ind.

ASC Joe L. Fields, Cynthia, Ky.

ASC Gerald C. Maggiacomo, Everett, Mass.

ASC Harold T. Camps, Coleman, Wis.

ASC Robert H. Moore, West Monroe, La.

ASC Archie T. Bourg, Baton Rouge, La.

ASC Clement O. Mankins, Fayette, Pa.

ASC Gerald H. Medeiros, New Bedford, Mass.

The Turkish government and the Air Force begin an intensive search for the missing plane.

• **Sept. 6:** The American Embassy at Mos-

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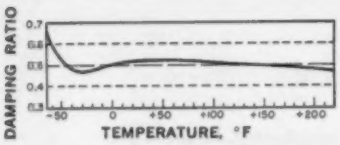

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cow delivers a note to the Soviet Ministry of Foreign Affairs, and the American Embassy in Tehran orally approaches the Iranian Foreign Ministry, asking for any available information regarding the plane and its crew of 17.

• **Sept. 8:** The Soviet Foreign Ministry orally informs the American Embassy at Moscow that the Soviet authorities conducting the investigation requested in the embassy's note of Sept. 6 desire to know in what region the plane might have approached the Soviet border. In response to the embassy's question, the Ministry states that the Soviet authorities have no information about the plane.

• **Sept. 12:** The Soviet Foreign Ministry delivers a note to the American Embassy at Moscow in which it is stated that a USAF aircraft has been found 55 kilometers northwest of Yerevan in Soviet Armenia. The note further states that remains of bodies were found "from which it is possible to assume that six members of the plane crew perished." The note charges a deliberate violation of the Soviet frontier. In answer to oral questions put by the United States Charge d'Affaires, Richard H. Davis, the Soviet Foreign Ministry states it has no further information to add to that given in the note. The Charge d'Affaires requests that a further search for the missing men be made, that an officer of the embassy or another United States official be permitted to visit the crash site of the plane and that arrangements be made for the transfer to American authority of the remains of the six crew members mentioned in the Soviet note.

• **Sept. 13:** The American Charge d'Affaires in Moscow delivers a note to the Soviet Foreign Ministry requesting information as to the whereabouts and condition of the 11 missing men and stating that the United States expects full cooperation from the Soviet government in granting access to the crewmen and in returning them. The note also requests that representatives of the embassy accompanied by technical experts as may be required to investigate the circumstances of the crash be permitted to visit the scene of the crash and that facilities be extended to them for effecting identification of the victims and arranging for the transfer of their remains to appropriate United States authorities. The note goes on to reject the Soviet charge that the plane intentionally violated the Soviet frontier and states that the United States government is unable to understand the delay of the Soviet authorities in furnishing it with the limited information contained in the Soviet note of Sept. 12 or the oral denial of any information made by a Foreign Ministry official. It states further that the United States Air Force has information to the effect that the plane was intercepted by three Soviet fighter aircraft in the region of the Soviet-Turkish frontier, that following the interception the plane proceeded eastward under the control of the Soviet aircraft, and that shortly after this an explosion was heard and a large column of smoke was observed rising at a point within Soviet territory. Finally, the note demands complete information regarding the circumstances surrounding and following the interception. In answer to a question of the Charge d'Affaires, the Ministry official to whom the note was delivered repeats that the Soviet authorities have no further information regarding the missing men.

• **Sept. 15:** The American Charge d'Affaires in Moscow, Richard H. Davis, asks Acting Soviet Foreign Minister Kuznetsov when a reply to the note of Sept. 13 will be forthcoming and if he has any further information on the missing men, pointing out the anguish suffered by the men's relatives. The Acting Foreign Minister replies that he has no further information, that a reply will be expedited, and that these unpleasant affairs would be avoided if American planes would stop penetrating Soviet airspace.

• **Sept. 17:** Soviet Deputy Foreign Minister Firyubin repeats the answers given two days earlier by the acting foreign minister to the same questions put by the American Charge d'Affaires.

• **Sept. 19:** The Soviet Foreign Ministry replies to the American Embassy's note of Sept. 13. The reply states that the Soviet government has no information on the 11 missing crewmen and indicates the willingness of the Soviet government to transfer to the American authorities the remains of six members of the crew found at the site of the crash. The note denies that Soviet fighter planes intercepted the USAF C-130 in the area of the Turkish-Soviet frontier. The American Charge d'Affaires again presses the Acting Soviet Foreign Minister for information on the 11 missing men but is told that the Soviet government has no information about them. The Charge d'Affaires also reiterates the request that American officials be permitted to examine the wreckage at the scene of the crash, but is informed that this would not be possible. In response to a question, the Acting Soviet Foreign Minister tells the American Charge d'Affaires that he has nothing to add to what is in the note concerning the circumstances surrounding the crash.

• **Sept. 21:** The American Embassy at Moscow delivers a note to the Soviet Foreign Ministry again requesting information on the missing 11 crewmen. The note also requests the transfer without delay of the remains and all materials which will facilitate identification of the six airmen who are known to have perished.

• **Sept. 24:** The remains of the six airmen are delivered by the Soviet authorities at Leninakan on the Soviet-Turkish frontier to the Air Attache of the American Embassy in Ankara.

• **Oct. 3:** The American ambassador at Moscow hands to the Acting Soviet Foreign Minister a note requesting further information on the plane. The note repeats the description of the interception of the USAF C-130 by Soviet fighter aircraft in the area of the Turkish-Soviet frontier and states that it must be assumed that the Soviet fighter pilots involved have knowledge of the circumstances surrounding the crash of this unarmed plane. The note states that in view of this, the United States government cannot understand why the Soviet government appears unable to furnish information on the circumstances of the crash or on the whereabouts and condition of the missing 11 airmen. After again rejecting the Soviet charge that the C-130 intentionally violated the Soviet frontier, the note requests information on the crash and on the missing men, requests that United States technical experts be permitted to examine the wreckage at the crash site, and states that the United States reserves the right to full

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compensation for the loss of the aircraft and its equipment.

• **Oct. 6:** In the course of a conversation on another matter raised by the ambassador, Deputy Under Secretary of State Robert D. Murphy requested Soviet Ambassador Menshikov for information on the missing 11 airmen and for access by United States authorities to the crash site of the C-130. The ambassador states that the Soviet government has no further information on the matter and that, since the crash site was probably in a restricted frontier area, the United States was asking to visit a closed area in the Soviet Union. Mr. Murphy asks Ambassador Menshikov to inform the Soviet government of his comments, adding that the United States has evidence that the C-130 was shot down.

• **Oct. 16:** American Ambassador Thompson is handed a note by Soviet First Deputy Foreign Minister Kuznetsov in Moscow. The note reiterates the statements contained in earlier Soviet communications on this subject to the effect that no further information is available and that the United States bears the responsibility for the incident.

• **Nov. 4:** The Air Force announces the identification of four of the six crew members who perished in the crash and whose remains were transferred to American officials on Sept. 24. The Air Force announces that the two crew members whose remains were not identified will be buried at Arlington National Cemetery with full military honors. The crew members identified were:

First Lt. John E. Simpson, Richland, Wash.

Capt. Rudy J. Swiestra, Compton, Calif.

First Lt. Ricardo M. Villarreal, Laredo, Texas.

Capt. Edward J. Jeruss, New Haven, Conn.

• **Nov. 13:** Deputy Under Secretary of State Robert D. Murphy receives Soviet Ambassador Menshikov, who is accompanied by Maj. Gen. Mikhail N. Kostiouk, Air Attache of the Soviet Embassy at Washington. Mr. Murphy presents the Soviet Ambassador with evidence that Soviet fighter planes intercepted the C-130 and shot it down.

• **Jan. 7, 1959:** Vice President Richard M. Nixon, during a conversation with Soviet First Deputy Premier Anastas I. Mikoyan, asks that the Soviet government give the United States government an indication or a statement about what happened to the 11 missing crew members of the C-130. Mr. Mikoyan replies that the Soviet government had given all the information it had.

• **Jan. 16:** The Secretary of State, during a conversation with Soviet Deputy Premier Mikoyan in the afternoon of Jan. 16, asks about the fate of the crew of the C-130. Mr. Mikoyan says that the Soviet government had done all that it could do. Mr. Mikoyan declares that the plane had not been shot down.

Radio Transcript

(Following is the State Department's translation of the conversation among the Soviet fighter pilots which the Department says was recorded during their attack on the C-130.)

I am at maximum speed . . .
Roger.
What is yours?
3,000.
I read you excellently.
583, I read excellently.
I read 18 excellently.
Understood altitude 100.
Understood.
In the northwest, about 7 balls here. (Seven balls apparently refers to the cloud layer below the air craft. Seven balls would mean 70% cloud cover.)
Very poor, almost none.
130?
Roger, 330.
582, I have taken course 330, altitude 80.
Roger, I am taking.
You are understood, altitude 90.
Roger, 40 kilometers.
. . . poor, I cannot see the orientation point yet.
No, not visible, it doesn't matter.
. . .
45 . . .
180 I have taken.
201, passed the second.
I am 201. I can see the fence well. ("Fence" is believed to be a reference to the Turkish-Soviet border.)
Roger.
Roger, proceed in a slight climb toward your point.
. . . altitude 100.
My course is 200.
Roger.
Roger.
Roger.
. . .
. . .
. . .
Roger, I have already turned toward the point, over 136, now I am turning toward 135.
Yes, I am over 136 now.
Roger.
Roger, I am approaching your point.
I am turning to 180, I am taking . . . to 135.
Roger . . .
Roger, I am approaching your point.
My altitude is 110.
Roger, I am looking.
I am climbing, I am 201, I am climbing.
Roger.
No, I . . .
. . .
Roger, . . . 582.
I am looking.
To the south there is, 2-3 balls.
582, I see the target, to the right.
I see the target, a large one.
Its altitude is 100, as you said.
I am 201, I see the target, attack!
I am 201, I am attacking the target.
You are understood.
I am attacking the target.
Stand by.
The target is a large one.
Roger.
Attack, attack, 218 attack.
Stand by.
582 . . .
Roger.
. . .
. . .
Roger.
Attack by four fourths.
. . .
The target is a transport, four-engined.
Roger.
Roger.
. . .
201, I am attacking the target.
. . .
218 . . .
. . . 201.
Target speed is 300, I am going along with it. It is turning toward the fence.
. . . the target is burning.
There's a hit.
. . .
The target is burning, 582.
The target is banking.
It is going toward the fence.
. . . open fire . . .
218, are you attacking?
Yes, yes, I.
The target is burning . . .
The tail assembly is falling off the target.
82, do you see me? I am in front of the target.
. . .
. . . look!
Oh?
Look at him, he will not get away, he is already falling.
Yes, he is falling, I will finish him off, boys, I will finish him off on the run.
The target has lost control, it is going down.
Now the target will fall . . .
82, a little to the right.
The target has turned over . . .
. . .
The target is falling . . .
218, no?
Do you see me?
. . . form up . . .
82, I see, I am watching the target, I see.
Aha, you see, it is falling.
Yes . . . form up, go home.
After my third pass, the target started burning.
. . . in succession.
Roger, I am turning . . .
Roger.
16,577, give the altitude, mission.
Who asked? I did not understand.
. . .
577.
Altitude 100, toward 135.
Roger.
Repeat, where are you?
On the left, on the left, below.
Well, let's form up, follow. Let's go.
I have tanks . . . the group.
Oh?
I have tanks.
Yes.
577, you passed 134?
Yes, yes, I am going toward 135.
I see you, proceed, contact the . . .
I am 201 . . .
Altitude is still only 3,000, but I will climb a little higher to there from below.
Roger, . . .
Roger.
Over 130 I am climbing.
Roger.
. . .
. . .
Yes, let's.
That's right, go off to the left.
. . .
We are beginning.
577, how do you read me? I am 16.
Excellently, I read you excellently.
You should be altitude 120, in the area of 134, 135; watch out for the fence.
Roger.
582, how do you read me? I am 16.
582, 16 is asking you.

(Continued on page 115)

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582, how do you read me? I am 16.
582, why don't you answer 16?
Roger, this is 577 talking to you.
Switch off . . .
I did not understand you, repeat.
Ah, no, not received yet.
582, how do you read me? I am 16.
I am 201, repeat what you said.
. . . I am located here to the north of 130.
I read you excellently, I am 577.
Well, I am between 134 and 35.
Roger, I am climbing.
Roger.
582, how do you read me? I am 16.
. . .
583, how do you read me? I am 16.
577, do you have communication with 82?
I will ask now.
582, I am 577, how do you read me?
Go home, why are you fooling around there some place?
Said he has gone home.
82, did you understand me? I am 577.
Roger, 582 to point 107, will land.
I am 16, Roger, you should be at 12 in that area.
Roger, Roger, I am climbing.
Roger, I will take 350.
Brakes.
Approach . . .
. . .
577, I have taken 350.
. . .
577, on communication. I am 16.
I read you excellently, my course is 350, I am proceeding to the far one.
Roger, where are you?
Approximately on the traverse of point 107.
Roger.
My altitude is 10 absolute, I am climbing farther.
16, Roger.
Roger.
577, your course is 100 deg.?
Yes, I am turning toward you, . . . ordered.
Roger, I see you.
Roger.
I read 129 excellently, I am 16.
I do not authorize.
577, for communication. I am 16.
I read you well.
I see you, approach the point from the north.
Roger, Roger, I am turning toward 130.
Give.
I am proceeding toward 130 from point 108.
I did not understand you.
Roger, I am going on 10, I am climbing farther.
Excellent, 11.
Roger.
I read you excellently, 11.
159, 12.
577, approach the point for a landing. I am 16.
Roger, I am descending.
Excellent, 11.
129, 12.
Excellent, 11.
I read excellently.
129, 12. 199, 11.
199, 12.
577, where are you?
I am approaching the old point.
How is your fuel?
Well, only the wing tank has run out.
I did not understand.

(*Continued on page* 117)

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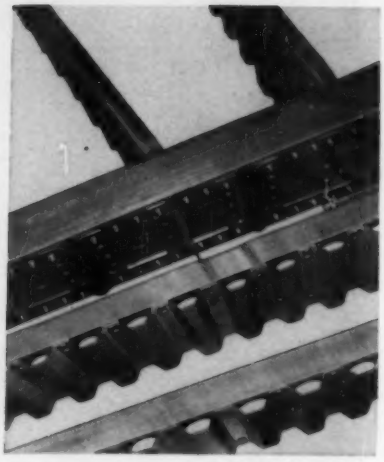

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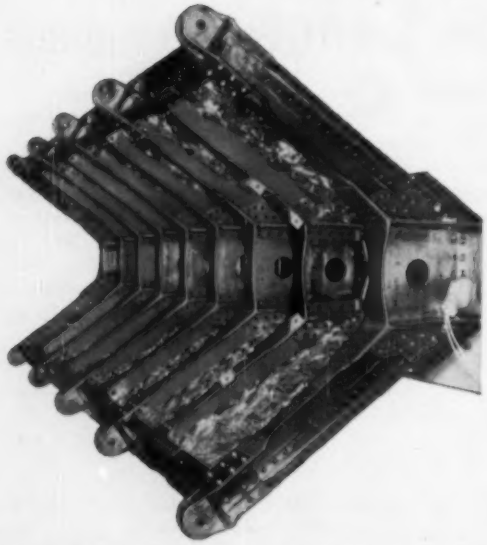

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The wing tanks have just now run out.
What is your altitude?
Well, altitude is 5,000, I am descending.
You should be at 5,000 over the point now.
Roger.
Excellent, 11.
Roger, . . . you have. Roger.
129, 12.
Roger.
577, you are descending, where are you?
I am approaching the small one, altitude 5.
Left turn, with an approach for landing.
Roger.
Excellent, 11.
I cannot.
77, over you.
Excellent, 11.
159, 12.
577, landing gear is down, landing.
Did not understand you.
Landing gear is down, landing.
I authorize landing.
Full flaps.
Roger, the wind is from the right at 90, two to three meters.
Roger.
After a run to metal.
Excellent, 11.
159, 12.
Excellent, 11.
199, 12.
Excellent, 11.
199, 12.
Excellent, 11.
199, 12.
Excellent, 11.
229, I cannot.
I read excellently.
. . .
199, 12.
Excellent, 11.
16, I am 573, how do you read me?
16, I am 573, how do you read me?
16, I am 573, how do you read me, for communication?
199, 12.
68, I am 573, how do you read me?
573, I read excellently.
Why is 16 silent there?
Just a minute.
81, I am 573, I have communication with mine, I am ending communication with you.
573, for communication. . .
I read well.
You also . . .
Now I am approaching the place where ours were working.
Roger, approach . . .
I am going close to our side.
81, how do you read me? I am 573.
. . . I am 573, how do you read?
It is necessary to go past orientation point 135, . . . orientation point 132 to the north, and far . . .

Sovetskaya Aviatsyia

(The two articles from Sovetskaya Aviatsyia released by the State Department are believed to be descriptions of the Soviet attack on the C-130, although no firm reference is made to an attack against an actual aircraft and it is inferred that the flight is a training mission. The articles which appeared in the Soviet air force newspaper approximately three weeks after the C-130 crash, Sept. 19 and Sept. 20, described the flight of four aircraft on an intercept mission. Two of the aircraft identified in the articles, 582 and 201, are also identified in the radio transcript of the Soviet pilots' conversation during the attack against the C-130. Course positions mentioned in the articles also are similar to those in the radio transcript. The articles were signed by a Maj. Meshkov.)

'Great Skill: Part I'

The vigilant fighting men at one of the anti-aircraft defense posts detected the aerial target. They did not know what it was or where it would go; however, they immediately assigned a number to the target and it was sent out for warning at once. The specialists at the radar set, who are always watchful and know their job well, immediately prepared for work and intensified observation of the air situation.

Now the target appeared on the command point plotting board. It was plotted by the senior plotter, Pvt. First Class Borshchenko who has a rating of excellent in combat and political training. This diligent and disciplined fighting man recorded the course of the "enemy" with short precise chalk marks.

Duty Officer Kulikov observed the work of the plotter. This officer has years of experience in flying operations, in the air battles of the concluding phase of the Second World War in which he shot down two enemy aircraft, and much experience carrying out missions for protection of the air borders of our native land.

Flights had been completed only 1-1½ hr. before this time. The fighting men at the command point had to work for a consid-

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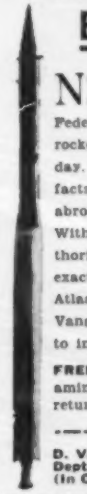

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erable time. They were checking the locations of aircraft in the air, vectoring fighter aircraft on targets, and doing everything possible to make flight control easy for the commander. The rest period did not last for long. "The senior chief decided to check our vigilance," thought Maj. Kulikov, and looked around by force of habit—all the specialists were at their places and ready for work. The first data which came in to the command point made Maj. Kulikov pick up his ears; the target, gaining altitude, was approaching the area guarded by the fighter pilots of air formation "X."

"The aircraft must be intercepted at maximum distance," decided the officer and informed the fighter aircraft to be ready.

The navigator, Capt. Romanyuta, who had just come on duty, and the plotters were at the table working on the vector plotting board. The first cross bearings on the movement of the target were made by Private Budarin according to the data which he received from the operator, Junior Sgt. Gvozdev.

The cross bearings appeared on the overlay at specific time intervals. Next to them were bare figures for altitude, speed and azimuth. After evaluating the air situation, Capt. Romanyuta quickly made calculations for scrambling the fighter aircraft.

"201, take off as a pair," ordered the officer. The reply: "There is a dust storm at the airfield. Takeoff is impossible."

This unexpected complication did not dishearten the officer. He pressed the microphone button again and commanded, "582, take off as a pair."

Other fighter aircraft received this command. Instantly the engines roared and quickly the pair of jet fighter aircraft are off to meet the "enemy."

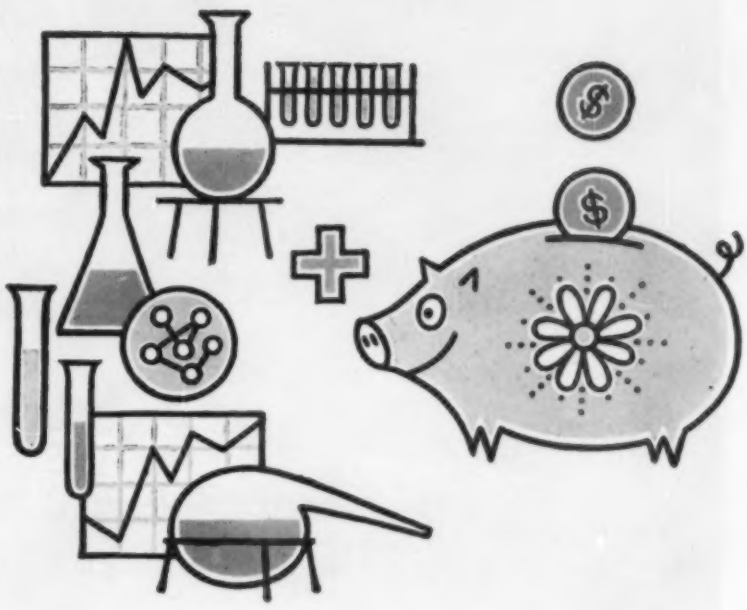
Seven minutes later when the dust storm subsided, two more interceptors took off. Immediately new cross bearings appeared on the overlay. The plotter, Pvt. Pankeev, started to work. According to information which he received from the rated operator, Brattsev, the fighting man first drew a line for the flight course of the fighter aircraft which had taken off for interception, and then began to plot the target.

In the same room Senior Lieutenant Communist Pavlov and Komsomol member Konstantinov are working bent over the brightly illuminated screens of the plan position indicators. Local objects hinder them in observing their fighter aircraft. However, they see the target well and inform the vectoring navigator, Capt. Romanyuta, concerning the character of its flight.

At all posts the well-trained fighting men are working—at the screens of the radar set, at the air situation plotting board and at the vectoring table. Now all their thoughts are directed at one thing—reliable tracking of the target, ensuring successful vectoring of the fighter aircraft and interception of the "enemy" on the distant approaches.

By their harmonious coordinated efforts they are accomplishing one great task. Every fighting man always remembers this and carries out his duties with great conscientiousness. Even here Capt. Romanyuta, although he was very busy, commended the excellent work of the operators and plotters—the tracking of the target was reliable and without gaps.

The navigator's calculations proved to



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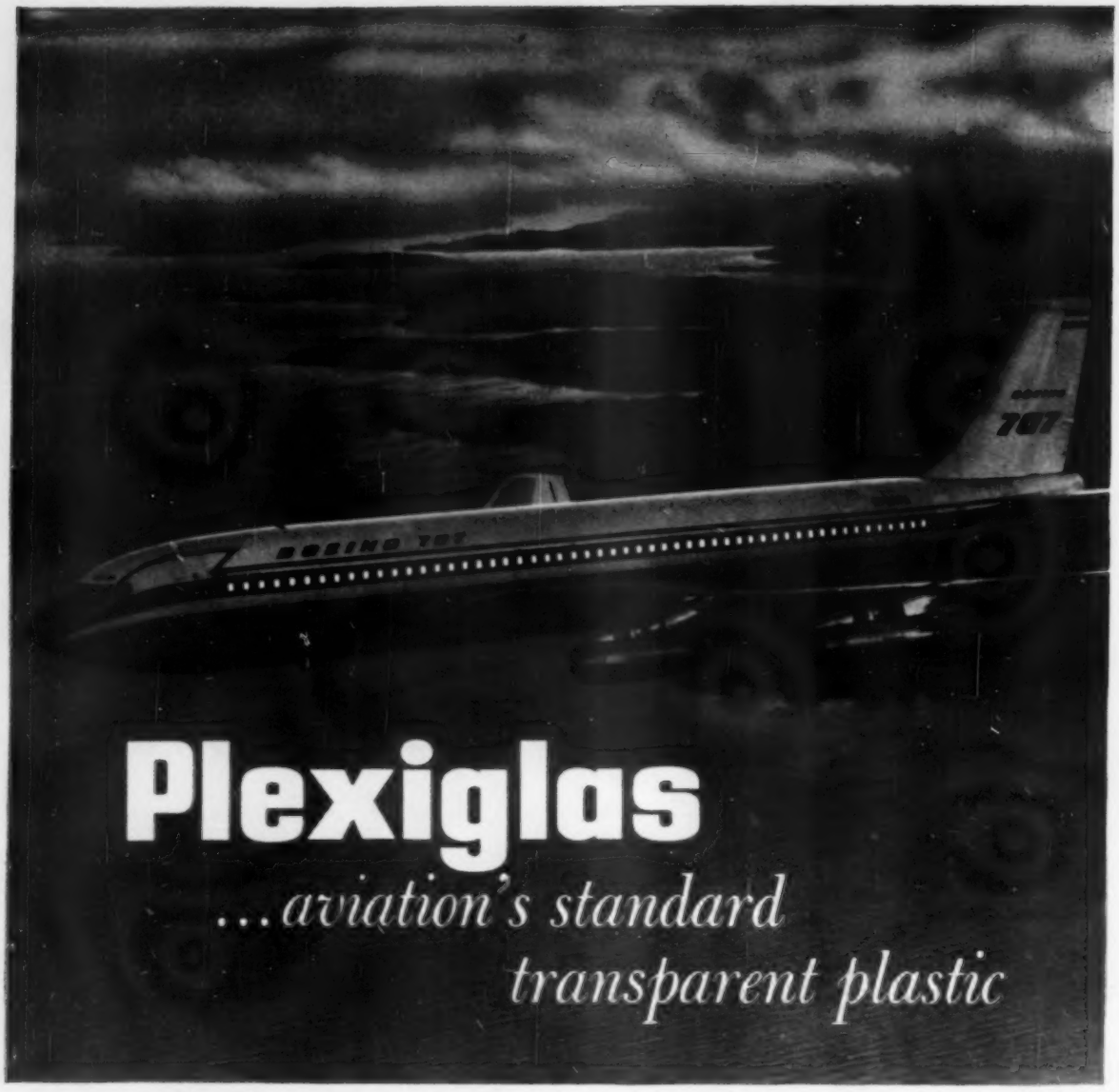

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be precise, and the commands fitted the situation. Steadily the fighter aircraft were approaching the indicated area. The tension in the work of the command point became still greater. It was necessary to direct the pilots into an initial position which was advantageous for attack and to ensure reliable control of the aerial "combat."

The busy season at the command point was in full swing.

'Great Skill: Part II'

"Combat readiness!" was transmitted to the airfield by radio.

Fighter pilots officers Lopatkov and Gavrilov hurried to their aircraft around which technicians were working.

They did not have long to wait. The pilots had scarcely taken their places in the cockpits, looked around and determined that all was in order when the command came. "582, take off as a pair." After takeoff the fighter aircraft received instructions to proceed to square "X." A few minutes were needed to get to the assigned area. Immediately the leader of the pair, Senior Lt. Lopatkov, reported this to the command point where Capt. Romanyuta was carrying out his duties at the vectoring table.

"Course 360, altitude 11," was transmitted from the command point.

Officers Lopatkov and Gavrilov are pilots in their third year of service. They have made only about ten flights apiece for interception of aerial targets. They have earned the praise of skilled fighter pilots by their persistence in acquiring techniques and skills and their fortitude in flights.

Fighting men are always proud to have such faith placed in them. Upon command from the command point they carry out each flight departure with special care and skill and put into it all their training, the remarkable powers of youth and the strong will of fighting men. On this day it was the same. The pilots carried out each command with the utmost precision. They understood well that timely detection and attacking of the target depended on their coordinated and precise actions. Course 330 . . . 300. And almost immediately, a turn to 180 deg. Having done this, Lopatkov and his wing man began to draw near the target. The "enemy" maneuvered in altitude and changed speed. However, the fighting men at the radar set tracked the target steadily as before. From various places the vectoring table received precise data on the flight of the target and the interceptors. Now two pairs of fighter aircraft were overtaking the "enemy."

With sparse, laconic commands, Capt. Romanyuta directed them closer and closer. Now he informs the pilot, "the target is in front, to the right, below."

Against the background of the variegated landscape, Lopatkov's practiced eye noted the silhouette of the aircraft. "I see the target!" said the pilot.

Lopatkov and Gavrilov, even though they were some distance apart, almost simultaneously thought that it would be necessary to "shoot" at the most vulnerable spots at close range.

The leader, Lopatkov, dashed in to attack first and switched on his gun camera. After him, officer Gavrilov attacked the "enemy." He succeeded in making three passes. When the wing man made a combat turn and broke off the attack, the second pair of fighter aircraft entered the "battle." These were Senior Lieutenants Kucheryaev and Ivanov. After them the first pair carried out another successful attack on the target.

"582, land at airfield 'X'." This order was not transmitted to the pair fortuitously. The fighter aircraft had little fuel and there might not be enough for the flight to their own airfield. Furthermore, the senior chief wanted to thank the pilots personally for exhibiting a high state of training and persistence in intercepting the target. Several minutes later the fighter aircraft landed at the airfield one after another. Excited and just a little tired after the interception just carried out, the pilots gathered together.

"That was fine," said Gavrilov quickly. "Just as in actual combat . . ."

"To be sure the flight was instructive," commented Kucheryaev.

The general drove up to the pilots. He shook their hands warmly and thanked them for their successful execution of the mission.

"We serve the Soviet Union," the officers answered simultaneously.

Somewhat later the developed films were shown to the general. This first-class fighter pilot looked them through attentively and remarked with satisfaction, "Good boys! The attacks were competent and rapid, and the firing was excellent."

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NORTH AMERICAN AVIATION, INC.

WHO'S WHERE

(*Continued from page 23*)

Changes

James W. Clyne, director-international commercial and military sales, Douglas Aircraft Company, Inc., Santa Monica, Calif. Also: **Russell A. Denzer,** staff assistant to the director; **J. W. Shaver,** European military sales representative (Geneva, Switzerland); **Bruce T. Dayton,** South American sales manager (Rio de Janeiro, Brazil).

Lyman C. Josephs, III, chief engineer-aircraft, Chance Vought Aircraft, Inc., Dallas, Tex.

Howard P. Mason, Pacific Missile Range base manager, Aerojet-General Corp., Azusa, Calif.

R. J. Mitchell, commercial manager, The Decca Navigator Co. Ltd., London, England.

John C. Riedel, senior project engineer-electronics, and **Donald E. Lovelace,** senior project engineer-transducers, Endevco Corp., Pasadena, Calif.

John M. Ruffner, industrial sales manager, Fenwal, Inc., Ashland, Mass.

John J. Marick, senior project engineer, Test Equipment Division, Consolidated Diesel Electric Corp., Stamford, Conn.

George W. Church, assistant manager-aviation products, Aviation Electronics Products Group, Bendix Radio Division of Bendix Aviation Corp., Baltimore, Md. **E. D. Hart** succeeds Mr. Church as engineering manager.

Ernest Leist, senior field engineer to head Aerojet-General Corp.'s field activities on the Navy Polaris fleet ballistic missile at Patrick AFB, Cape Canaveral, Fla.

William C. Woodward, manager-aircraft and missiles sales, Aluminum Company of America, Cleveland, Ohio.

Edward W. Schening, general manager, Military Electronic Computer Division, Burroughs Corp., Detroit, Mich.

John R. Harkness, electronics manager, Bendix-Pacific Division of Bendix Aviation Corp., North Hollywood, Calif.

Wensley Barker, Jr., staff engineer, Chandler-Evans Corp., West Hartford, Conn.

William T. Lucas, manager-navigation systems sales, and **Eugene T. Mueller,** manager-communications and sonar sales, Electronics Division of Stromberg-Carlson, a division of General Dynamics Corp., Rochester, N. Y.

Robert V. Burns, manager of the Dayton, Ohio, office of The Martin Co., Baltimore, Md.

E. H. Schaefer, chief of the newly established Manufacturing Engineering Department of Autonetics, a division of North American Aviation, Inc., Downey, Calif.

Dr. Douglas Duke, technical advisor in space technology, Radiation, Inc., Melbourne, Fla.

W. J. Chadburn, manager of field operations-electronics, Aeronautical and Instrument Division, Robertshaw-Fulton Controls Co., Anaheim, Calif.

Dr. Edward K. Blum, director, and **Donald W. Gantner,** associate director, Computation and Data Reduction Center of Space Technology Laboratories, Inc., Los Angeles, Calif.

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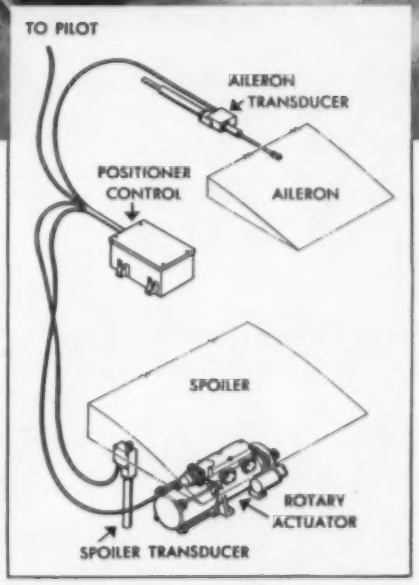

A substantial increase in aileron effectiveness is achieved by the AiResearch Spoiler Servo Control System which augments the function of the aileron by increasing the rate of roll of the aircraft. Full spoiler surface travel is achieved in 0.5 seconds by electromagnetic clutching of the 4 H.P. power servo.

The added control surface of the Spoiler Control Servo System operates on the inboard side of each aileron. This AiResearch electro-mechanical system automatically synchronizes the spoiler control surface to move simultaneously with the aileron by utilizing a magnetic amplifier and position transducers in the closed loop servo system.

This new Spoiler Control System is but one of the many types of electro-mechanical systems developed and manufactured by AiResearch. Other recent examples include radar antenna positioning equipment, magnetron and Klystron tuning devices, and safe-arm mechanisms for missile igniting.

The company's more than 20 years of experience in the development and manufacture of electro-mechanical equipment extends into aircraft, ground handling, ordnance and missile systems of all types. AiResearch capability and system responsibility can meet your specific electro-mechanical requirements. Your inquiries are invited.

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MAGNETOHYDRODYNAMICS

EXPANDING THE FRONTIERS OF SPACE

MAGNETOHYDRODYNAMICS [illegible] Annual Symposium* on this important new field—which deals with the effect of magnetic fields on the behavior of ionized gases—attracted physicists from all over the world. This year the meeting centered on the investigation of control of high-speed vehicles by magnetically interacting changes in air flow. As portrayed by the artist, today's earliest experiments in magnetic forces involved the use of the ancient lodestone—forerunner of investigations and theories by scientists today into the magnetic forces of the solar prominences.

Lockheed Missiles and Space Division has complete capabilities in more than 40 areas of science and technology—from concept to operation. Headquarters are at Sunnyvale, California, on the San Francisco Peninsula, with research and development facilities located in the Stanford Industrial Park in nearby Palo Alto and at Van Nuys in the San Fernando Valley of Los Angeles. A 4,000 acre, company-owned test base, 40 miles from Sunnyvale, conducts all phases of static field testing. In addition, complete flight testing is conducted at Cape Canaveral, Fla., Alamogordo, N.M. and Vandenberg AFB, Calif. as an integral part of every stage of missile and space programs at Lockheed.

The Division's advanced research and development programs now under intensive study provide a fascinating challenge to creative engineering. These programs include: man in space; space communications; electronics; ionic, nuclear and solar propulsion; magnetohydrodynamics; oceanography; computer research and development; operations research and analysis; human engineering; electromagnetic wave propagation and radiation; materials and processes and others.

Lockheed's programs reach far into the future and deal with unknown environments. It is a rewarding future which scientists and engineers of outstanding talent and inquiring mind are invited to share. Write: Research and Development Staff, Dept. BB-17, 962 W. El Camino Real, Sunnyvale, California.

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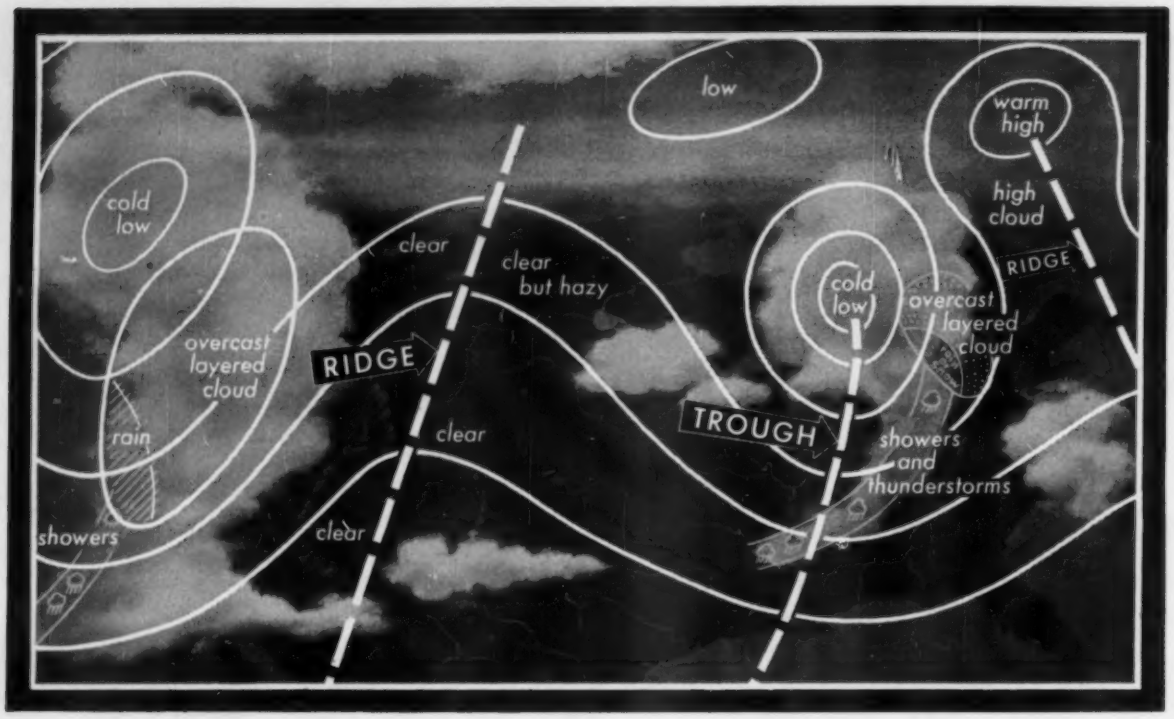
*Copies of the proceedings of the first two symposiums were published by the Stanford University Press, Palo Alto, Calif. and are available in book form. Results of this year's symposium will be published shortly by the same house.

Mobil

FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau



CIRCULATION PATTERNS

Clockwise circulation of air around High Pressure areas and counter-clockwise flow around Lows in the northern hemisphere are well known to most pilots. However, there are some lesser-known features of Highs and Lows which have become apparent with the progress made in upper air analysis.

Warm Highs—Extend to levels above 10,000 ft. with temperatures generally warmer than Standard Atmosphere. As this type of High extends farther aloft, it often assumes an elliptical shape with major axis lying N/S to form a *Ridge*. This Ridge normally moves very slowly, blocking eastward movement of weather systems at lower levels, often causing prolonged periods of fair or rainy weather in adjacent areas. Weather in warm Highs is usually dry, fair and often hazy.

Cold Lows—Extend to high levels with temperatures generally colder than Standard Atmosphere. Their normal eastward movement slows until sometimes the center aloft becomes stationary or even retrogrades westward. This is called a Cold Low because of concentration of cold temperatures near the center. V-shaped elongation of these Lows toward the south is referred to as a *Trough* and marks region of wind shift and possible clear air turbulence.

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DESIGNER BENSEN sits between tandem rotor-props of new B-10 VTOL prototype.

Bensen Tests Low-Cost VTOL Powered by Tandem Rotor-Props

By Erwin J. Bulban

Sport gyroplane designer Igor Bensen has been testing a new low-cost powered vertical takeoff and landing aircraft which he expects to have fully developed and ready for production this summer, AVIATION WEEK has learned. Bensen's tandem twin-fan single-place prototype has accumulated approximately 15 hr. of flight time to date.

Bensen Aircraft Corp., of which the designer is president, plans to interest both the military and civilian markets in his new Model B-10 VTOL by emphasizing the low cost, design simplicity and easy piloting characteristics of the aircraft. For civilian users, the aircraft will be available in either kit form or shipped ready-to-fly, as are his previous sport gyroplanes.

Although actual price information is not available, an informed source states that actual hardware cost of the prototype has been under $3,000. Entire development cost on the Model B-10 so far has been approximately $15,000. Detailed information is unavailable, but the flight photograph of the aircraft shows that the tandem rotor-propellers are unshrouded and that a system of airfoil-shaped longitudinal and transverse control and stability vanes are employed. Powerplants are vertically mounted 72-hp. McCulloch four-cylinder aircooled engines. First flight was last Aug. 6.

Model B-10 is latest in Bensen's plan to encourage a "grass-roots" interest in sports flying among teen agers and aviation enthusiasts who have dropped active interest in flying because they believe costs of buying and operating conventional aircraft are too high.

Since he began operations at Raleigh-Durham Airport, N. C., in 1953, following previous rotary wing design work with General Electric Co. and Kaman Aircraft Corp., Bensen has developed and sold a series of light unpowered and powered gyroplanes. He estimates that to date between 1,000-2,000 of his several types of plane are now being flown in the U. S. and abroad. He also estimates that he has sold several hundred in ready-to-fly form at a price of $999 each.

By far the largest number have been built from kits or plans. He knows that in many cases several enthusiasts have joined to purchase a single set of plans from him and built a number of the aircraft.

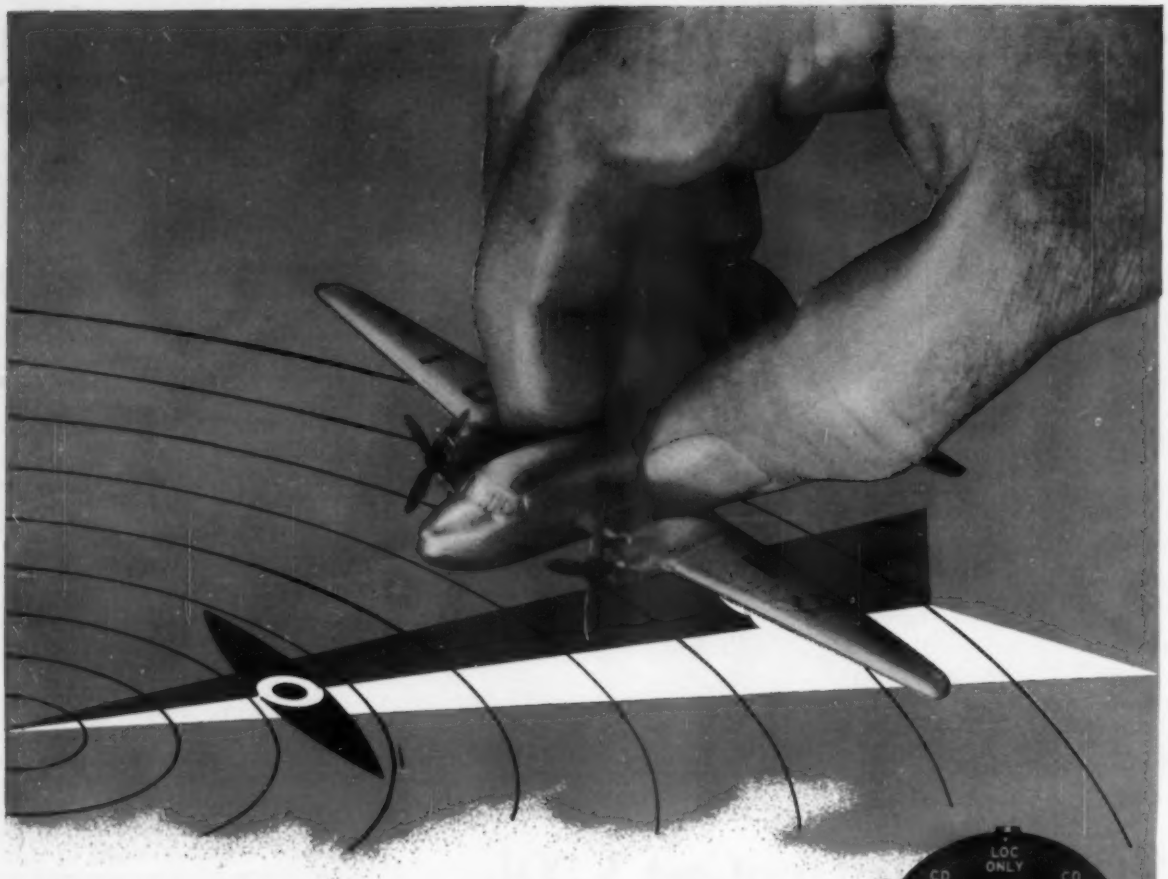
According to Bensen there are a number of gyroplane clubs active in this country; one in Michigan has already built nine aircraft and plans to build three more.

His powered versions have had less success than the Gyro-Glider type, primarily because they are designed for single-ignition engines—Federal Aviation Agency requires that aircraft use dual-ignition engines if they are to be type certificated. A number of powered Bensen Gyro-Gliders have been built here in the experimental home-built classification, he told AVIATION WEEK.

Overseas, particularly in so-called undeveloped countries where requirements are less critical, over 100 powered units have been sold, he stated. Powered models are priced at $2,995 with engine.

USAF Gets First Helio STOL Aircraft

Three Helio L-28A Super Courier STOL aircraft have been purchased by USAF to evaluate operational techniques of the design and their use in supplying isolated stations. Powered by 295-hp. Lycoming, 3,000-lb. Super Courier cruises at 170 mph.



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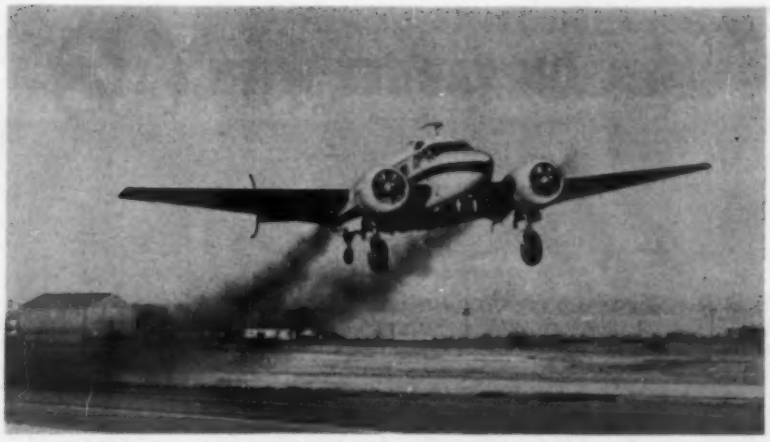

JATO ROCKETS boost Super 18 twin-engine climb rate nearly 600 fpm.; by 500 fpm. on one engine with airplane at full gross weight.

JATO Approved for Super 18

First business airplane of under 10,000 lb. gross weight to be fitted with FAA-approved factory-installed standby rocket motors for emergency use, has been delivered by Beech Aircraft Corp. to Weyerhaeuser Timber Co., Tacoma, Wash. Delivery followed development of the installation and an extensive flight test program at the airframe manufacturer's Wichita, Kans., plant on the Weyerhaeuser Twin Beech Super 18. Installation of the new Aerojet-General 15NS-250 "Junior JATO" rocket motors, installed behind each of the airplane's 450-hp. Pratt & Whitney R985-AN14B piston engines, showed following results during tests:

- **Increase of 500 fpm.** in single-engine rate of climb, with airplane at full gross weight.
- **Increase of 578 fpm.** in twin-engine rate of climb with airplane at 7,600 lb. weight.

Beech currently has a backlog of eight additional Super 18s to be fitted with the Aerojet-General 250-lb. thrust Junior JATO rocket motors, a company spokesman told AVIATION WEEK. In addition to providing factory installations, the company is also developing a kit which customers may have fitted to their Super 18s in the field. The rocket motors are offered as optional factory-installed equipment at price of $2,960. Kit will be considerably under this figure since installation cost will not be included.

When fired simultaneously, the Junior JATO motors add approximately 100 hp. each to the Super 18's piston engines to provide a considerable extra safety margin in event of primary power loss on takeoff or any other requirement for instantaneous power increase exceeding normal engine performanace.

Approval of the installation of the

ONE SWITCH (left) fires both rockets at once. Motor is placed in engine nacelle (right).

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For more information please write to: Mr. A. B. Stevenson, Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

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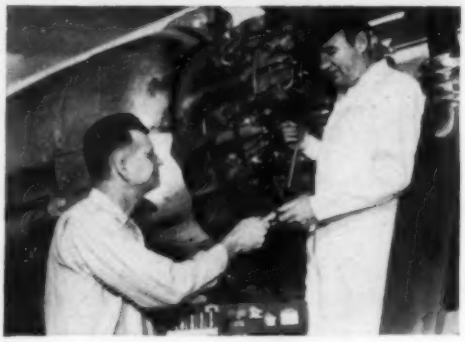
Director of Engineering and Maintenance Harvey P. Barnard, Jr. states, "AC *aircraft* Spark Plugs are doing an excellent job for FAL! One of the reasons we like AC-271's is because their construction reduces possibility of moisture or contaminants in the spark plug barrels!"

AC aircraft Spark Plugs have been proved in millions of miles of flying in commercial, private and military planes. You'll find them best for the planes you fly. Massive or platinum electrode, get the AC aircraft Spark Plug designed to give you the best performance in your operation and in the type of aircraft you fly!



Robert Eakle (L), Assistant Foreman Accessory Shop, and Lead Mechanic John Brennan (R) installing AC-271's in FAL plane.

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS

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Van Dusen Aircraft Supplies, Inc.: Chicago, Illinois; Minneapolis, Minnesota; Teterboro, New Jersey; East Boston, Massachusetts; Alexandria, Virginia; Richmond, Virginia; Miami, Florida.

Junior JATO rocket motors in aircraft of the Beech 18's weight class will broaden the already widespread application of Aerojet-General's equipment in the business plane fleet. A large number of executive Douglas DC-3s, Lockheed Lodestars and Venturas, Convairliners and other similar category transports have been operating with the company's larger 1,000-lb.-thrust Model 15KS-1000-A1 aircraft standby rocket motors for several years. Aerojet-General reports that more than 100,000 of the larger units have been operated successfully in military and civilian aircraft.

Each Junior JATO will deliver its 250-lb.-thrust, equivalent to about 100 hp. at 100-mph. velocity, for 15 sec., full thrust being developed almost instantly after an electrical switch in the cockpit is activated by the pilot. Power rating is based on sea level temperature of approximately 59F; thrust varies upon temperature.

Beech notes that at −65F, each Junior JATO will produce approximately 195 lb. thrust; at 60F, 260 lb. thrust; at 160F, each will produce 360 lb. thrust. In discussing increased horsepower provided by the motors, the company says they produce from approximately 90 to 110 hp. each, depending upon temperatures. Duration also varies depending on temperature: at −65F, duration of the motors is 19 sec.; at 60F, 15 sec.; at 160F, duration is 11 sec.

Each self-contained solid-propellant motor weighs approximately 50 lb. installed, the propellant in each unit accounting for aproximately half of the motor's 42-lb. weight. Standby carriage life of each motor is 500 flight hours or one year, whichever occurs first. As the units approach the end of their certificated life, they can be operated for pilot familiarization and then replaced. Units are not recharged.

Alouette II Operates In Yosemite Area

Diverse operations handled by Aetna Helicopters' Republic Alouette II turbine-powered helicopter in the past few months include spraying blight-infested forests in Yosemite, aiding a water resources research project, providing airlift on a construction job and hauling forest fire fighters and their equipment.

The Alouette's most challenging job to date, according to Aetna manager Robert Trimble, was to fly 9,000 lb. of bulky freight to the bed of the American River in primitive Forest Hills country near the base of the Sierras. Time for the airlift: 2 hr. 12 min.

Job required carrying seven sections of conduit, each six feet long, four feet in diameter and weighing 460 lb. These were carried two at a time, lashed verti-

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WING TIPS

TAUT ISN'T RIGHT. When securing your plane with rope, it's a good idea to leave a little slack in the lines. Otherwise, if they get wet and contract, they might pull too hard on the aircraft's structure . . . causing damage that might go undetected. Many planes are now being secured with light chains to eliminate this hazard.

FUELS. Esso is one of the world's major suppliers of jet fuels. Pan American, American and many other airlines also use Esso Turbo Oils to lubricate their jet engines. Esso Aviation Fuels help all planes – large or small, prop or jet – get top performance. You can depend on Esso Aviation Fuels to give your plane's engine the utmost in power and economy.

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Piper, Cessna Gain

Gains in sales volumes in the first quarter of their fiscal years are reported by Piper Aircraft Corp. and Cessna Aircraft Co.

Piper notes a 36.6% increase in sales over the same period last year, gross for the three months ending Dec. 31, 1958, totaling $7,462,319, with net income being $556,505 an increase of 13.4% over last year's initial quarter.

Cessna notes sales totaling $20,830,000 for the first quarter, ending Dec. 31, compared with $20,772,000 in the same period last year.

Piper expects further increase in sales volume resulting from step-up in twin-engine Apache production to from one to one-and-a-half a day in January. This spring Piper will introduce its 200-mph.-plus Aztec light-twin business plane and will schedule twin-engine plane production for two per day for the balance of the year. Early this summer, the company will begin production of its Pawnee agricultural plane. Output of Comanche four-place business planes is holding firm at four per day.

Cessna expects that 1959 commercial aircraft sales should exceed its record-breaking 1958 volume, and also expects profits of its new subsidiary, Aircraft Radio Corp., to be materially higher this year than in 1958.

cally on either side of the fuselage behind the cockpit. In addition, the Alouette ferried a 610-lb. rotary compressor, bags of cement, 600-lb. reels of cable and other equipment for installation of the 42-ft. housing for a water measurement station erected by the California Department of Water Resources. Only overland access to the canyon was a steep and narrow path which prohibited movement of the conduit.

During construction of a complete Park Service fire lookout station built near the top of 10,400-ft. Mt. Mitchell in the Sierra Nevada range, the Alouette flew better than the promised one-ton-per-hour of 25,000 lb. of building equipment and supplies. During the operation the base field was moved from a spot two miles away from the look-out to another field 11 mi. away. Four construction men were also ferried back and forth from a base station at 7,800-ft. altitude.

Loads during this project included whole prefabricated roof and wall sections, cement, lumber, building tools, a compressor, stove, refrigerator and kitchen sink.

In addition to ferrying supplies the Sud-designed turbine-powered helicopter flew a series of fire missions, averaging seven hours of flying per day during a five-day period.

Airlift carried four men a trip in addition to 250-300 lb. of equipment, Trimble reports.

Soon after, the National Park Service hired Aetna's Alouette to spray a 100-acre patch of blighted pine near the crest of the Sierras near Yosemite National Park. Operating at 9,400 ft. altitude, the aircraft sprayed a total of 2,000 gal. on the area, averaging two and a half acres in six minutes. Best previous time with other helicopter types was about an acre in six minutes, Trimble states.

The Alouette was fitted with two specially-designed tanks capable of carrying up to 80-gal. a trip.

Umbaugh Signs Production Agreement

Contract for production of Umbaugh Model 18 two-place $10,000 rotary wing aircraft has been signed with Colonial Aircraft Corp., Sanford, Me., builder of Skimmer amphibious business plane. Initial production unit is scheduled to leave Colonial's line this month—Umbaugh reports that it hopes to have 1,000 built by October of this year. Fitted with 180-hp. engine, Umbaugh 18 is said to have cruise speed of 100 mph. at 65% power and maximum endurance of 4.5 hr. with normal fuel load of 30 gal. Maximum gross weight is given as 1,600 lb., length as approximately 20 ft., height as 10 ft. 6 in. Free spinning rotor provides aircraft with lift.

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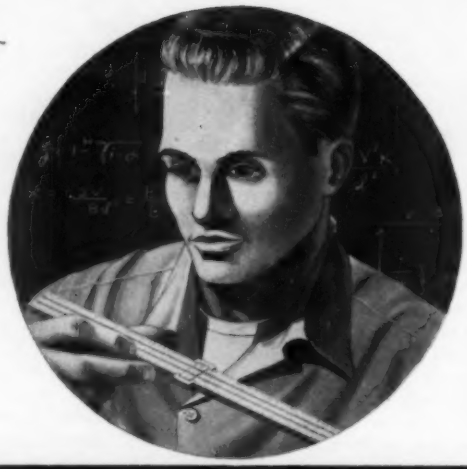

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CLEANED-UP COWL in 1959 Cessna Skylane, priced at $17,095, boosts speed two miles-per-hour. Cowl features streamlined nose cap.

Cessna Raises 1959 Line's Price

Aerodynamic cleanup and revised interiors mark the 1959 models of Cessna Aircraft Co.'s "mighty middle line" of business planes–Skylane, Model 182 and Model 180. Changes have resulted in slight performance gains for Skylane and Model 182.

Increased prices are also evident for the 1959 models of these four-place business planes: Skylane is now priced at $17,095 compared with $16,850 last year; Model 182 is listed at $14,600 compared with $14,350 previously and the Model 180 now sells for $14,250 compared with $13,850 last year.

Maximum and cruise speeds are increased two miles per hour for both the Skylane and Model 182. Gain was achieved primarily by redesign of the forward fuselage area and engine cowling. Cowl features a new, more streamlined nose cap and lower cowl is designed to provide better fairing around the nose-wheel strut. Right cowl access door has been eliminated to provide a cleaner airflow.

Cowl redesign provides improved air filtering system, Cessna reports. Carburetor air filter has been moved higher in the nose cap to provide a cleaner air course and improved accessibility. Air induction system has an adapter duct for delivering filtered air to the carburetor from the filter. Duct is integral with the lower cowl and is attached to the carburetor air box. Intake for alternate air source has been moved above the engine inside the cowl for additional protection from dust. Cowl flaps are installed to provide cooling during take-off and climb, flaps being operated by a pull-push control in the cockpit.

All three models have 230-hp. Continental engines with new four-ring pistons to enhance service.

Wing strut fillets have been made standard equipment on the Skylane, which is the de luxe, fully-equipped version of the Model 182. Fillets are of Royalite and incorporate a larger retractable tie-down fitting. Skylane and Model 182 now are fitted with a single-piece cast assist step extending approximately five inches ahead of the landing gear leading edge.

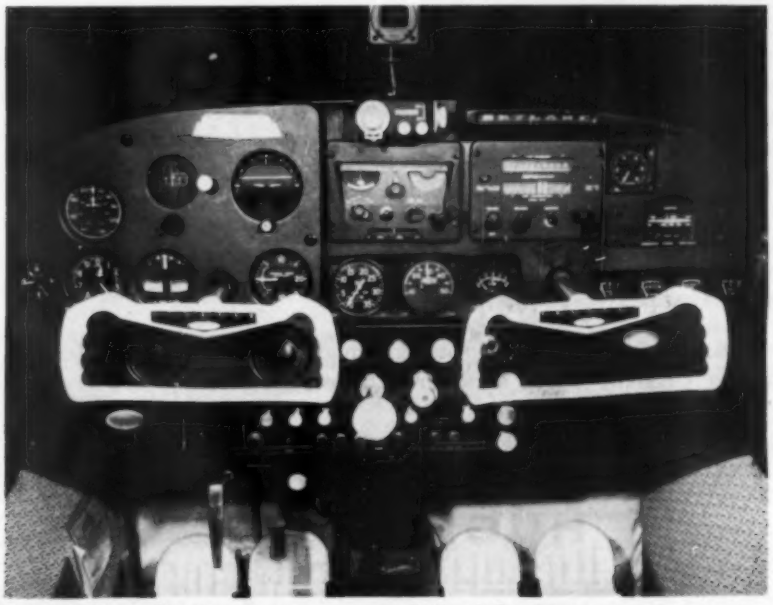
Forged upper and lower door hinges replace former steel stampings; the new hinges were installed to provide increased rigidity and better sealing of door to the fuselage. Upper hinge is additionally strengthened by use of a decorative web.

All three airplanes have a redesigned instrument panel providing shock-mounted instrument group in front of the pilot with controls for navigation and flight instrumentation; engine instruments are placed on a stationary panel, permitting arrangement of fuel capacity, oil pressure and oil temperature gages above the glove compartment on the right side. Panel has provisions for two radios and an ADF along the top center, with space above the center-mounted radio for installation of Tactair's Levelair T-1, T-2 or T-3 auto-stability-autopilot equipment.

Instruments in the stationary panel are mounted using a metal bezel and flush screws, eliminating need for removing nuts from the rear of the instrument when it is taken from the panel.

Tilting front seats are now offered as optional equipment, the seat back being hinged to the seat bottom so that the back reclines when the bottom is raised to the three adjustment positions.

Skylane top speed is now 170 mph. Cruise speed is up to 160 mph. Range at maximum cruise has been raised from 667 mi. to 675 mi., and maximum range is increased from 819 to 845 mi. Model 182 cruise and top speeds have been increased by Skylane figures. Range has been improved from 805 to 835 mi.



INSTRUMENT PANEL has instruments regrouped; Tactair Levelair is mounted top center.

New Customs Ruling To Ease Border Flights

United States Customs Bureau is issuing instructions to its officers along the Canadian border easing clearance problems of outgoing commercial charter and air taxi operators.

According to a letter sent Sen. William Langer (R.-N. D.) by the Acting Commissioner of Customs, operators may be permitted to clear flights into Canada by telephoning the nearest cus-

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announces the establishment of

a major new division . . .

the COMMUNICATIONS DIVISION

The growing importance of global and space communications, together with major contributions of the Hughes Communications Laboratory, such as the Long Arm and Quicksilver programs, has resulted in the creation of the COMMUNICATIONS DIVISION of the Hughes Aircraft Company. The new division is fully integrated and will be responsible for communications research, development, manufacturing and sales. Expansion plans are ambitious and aggressive, and the backlog of contracts already awarded promises an expansion consistent with the spectacular records established by the other major divisions of Hughes Aircraft Company.

The establishment of Hughes as a major factor in the communications industry has created many openings for experienced electronic engineers in the following areas:

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For further information write Mr. John Melville at the address below.

HUGHES

COMMUNICATIONS DIVISION, P. O. Box 90-902, Los Angeles 45

toms office prior to departure and filing by mail the outward general declaration for the aircraft. This policy will apply when the charter aircraft is carrying passengers for hire but no cargo, or is departing without passengers or cargo in order to pick up passengers in Canada. This will simplify procedures for operators who are not located close to U. S. customs offices along the border. In the past the required documentation had to be delivered in person by the charter pilot to the customs inspector before leaving the United States.

In the case of one operator, this prior requirement meant flying 200 mi. additional to file outgoing papers and could add up to $40 to the trip.

PRIVATE LINES

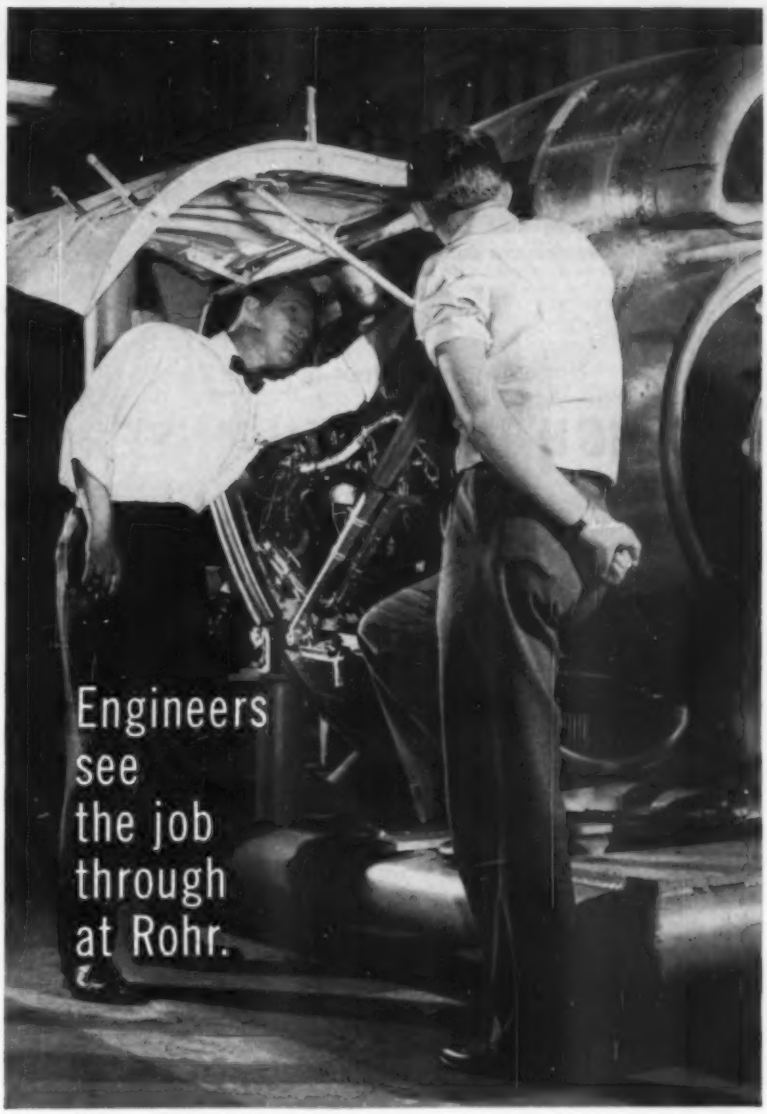
Manufacturing and sales rights to twin-engine Baumann Brigadier business airplane have been acquired by Falcon Aircraft Manufacturing Co., Marana Air Base, Tucson, Ariz. P. H. Burns is president of Falcon.

Two-seat lightplane, powered by a 93-hp. Praga engine, has been developed by Rosu Aircraft Factory, near Bucharest, Rumania, for use by flying clubs. Cruise speed of Rg-6 is 110 mph. Span is 34.47 ft., length 24.99 ft. and empty weight is 1,452 lb.

Nominations are sought by the Women's Aeronautical Assn. of Kansas for its annual Business Flight Safety Award, to be presented this fall at the National Business Aircraft Assn.'s 1959 forum at Minneapolis, Minn. Sterling silver trophy is given each year to the person who makes the most outstanding contribution toward improving business flight safety and making it the safest means of travel. Deadline for nominations on 1959 trophy is May 1. Women's Aeronautical Assn. of Kansas address is: P. O. Box 1676, Wichita.

General Aviation Council is new name for former General Aviation Facilities Planning Group, a voluntary association of 11 business and private flying groups, initially formed to provide information on general aviation for President Eisenhower's special aviation assistant, Edward P. Curtis. Chairman of the new council is Joseph B. Burns. Joseph T. Geuting, Jr., is secretary-treasurer.

Survey of how airplanes are used in Michigan will cover some 2,300 aircraft owners. Initial portion of survey will cover personal planes; second part will deal with business aircraft. University of Michigan is conducting survey for state's Department of Aeronautics.



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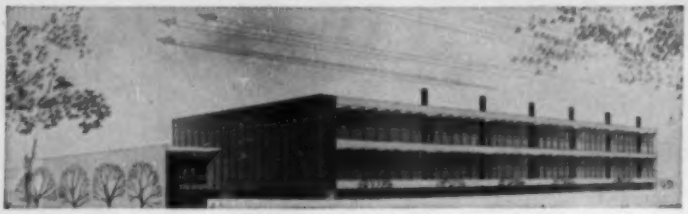

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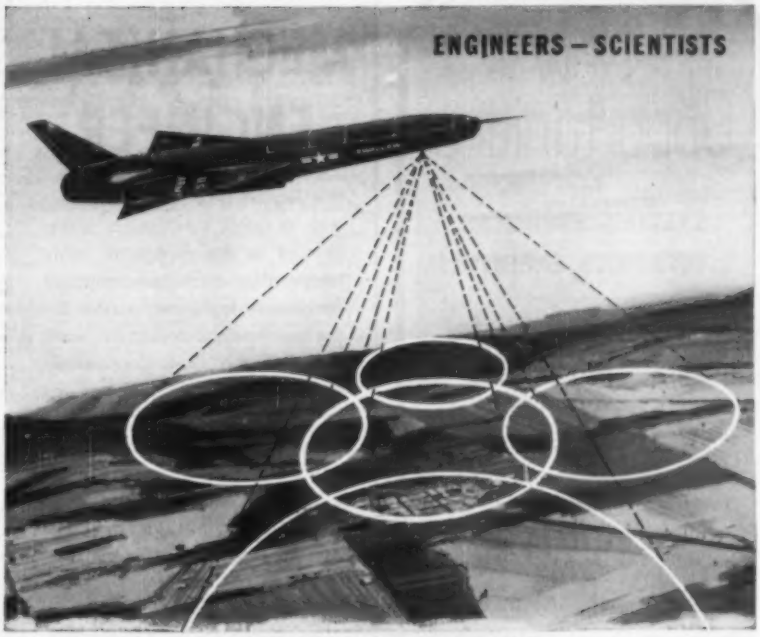

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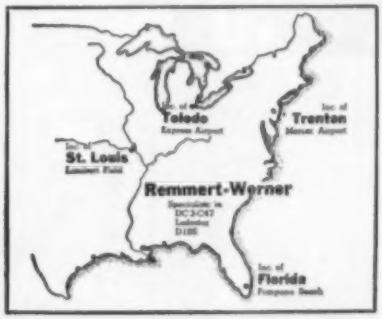

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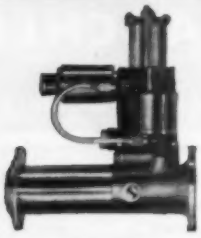

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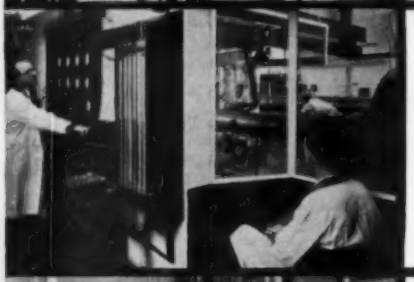

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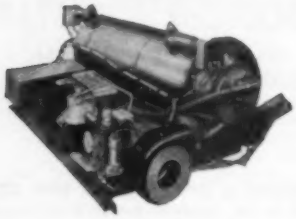

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LETTERS

Air Cushion Study

This letter concerns your worthwhile article entitled "Designers Study Air Cushion Principles for Vehicles" in the Jan. 12 issue (p. 74) of AVIATION WEEK. I wish to take this opportunity to invite your attention to several chronological developments of interest in the ground proximity effect with an annular nozzle. I might add that Dr. Boehler, in his recent paper for the American Helicopter Society, had an excellent summary of the chronological interest in this field of ground supported vehicles.

I believe that, in particular, the work conducted by the NACA (now NASA) mentioned in your article requires amplification. The research at the Lewis Research Center was initiated about June, 1954, at which time a very small-scale feasibility study was performed. The model used at that time is shown in figure 4 of NACA TN 3982. Because of the large work load at that time design of a larger scale setup was delayed until June, 1955, and data was obtained starting in March, 1956. This latter data is also reported in NACA TN 3982. This report was released in April, 1957. Mr. H. R. Chapman's analytical study was published in July, 1957. As he indicates in his abstract, "The results are found to be in agreement with experimental data." Thus, the ground proximity effect with an annular nozzle was determined first experimentally and later verified analytically. Your article in its last paragraph implies the opposite.

The schlieren pictures shown in NACA TN 3982 show that the jet is turned outward close to the ground; hence, one of the problems in the analytical approaches by Messrs. Boehler and Chapman was to obtain an approximation of this jet shape in order to simplify the analytical procedures.

UWE H. VON GLAHN, Chief
Flow Physics Branch
Fluid Systems Division
National Aeronautics and
Space Administration
Lewis Research Center
Cleveland, Ohio

Super Regimentation

H. B. Davis of Burbank, Calif., in discussing what he called "lightplane rule enforcement," was in over his head when he wrote his first letter. But now that he's elaborated even more in his second letter (AW Jan. 17, p. 122) he's really compounded his problem.

It's obvious that Mr. Davis, as he says, has ". . . averaged one hour a day in fighter type aircraft for the last 16 years." He's apparently spent most of his aviation career in an atmosphere of super regimentation. He's done this for so long, in fact, that I think his judgment has become warped. His attitude, however, is not as uncommon as it might seem at first glance. There are quite a few of these super-professional birdmen who feel strongly that the common man who happens to fly ("the lightplane pilot" he keeps talking about) must either be required to perform like a true professional, or get out of the air entirely. This is one of aviation's most prolific forms of snobbery, and it's a hard one to overcome. By his standards, there is no such thing as an average American citizen. There's no room in his world for ordinary human foibles; of course, he has somehow learned to accept such shortcomings on the ground, but I'm afraid that he has himself a real problem in the air.

Mr. Davis once again propounds the theory which is often discussed but never made to work. In his mind there is always a Superman at the top. Nobody makes a move with an airplane until Superman studies the proposed move, somehow evaluates the ability and judgment of the pilot proposing the move, and then "gives the signal." Mr. Davis has been so thoroughly indoctrinated by his military experience that he can't conceive of any other way of living in the airspace. The fact that the present FAA already has several employes for each airplane in existence in the United States apparently is unknown to Mr. Davis and his kind. He would only have to imagine—and without much effort on his part, at that—how the many millions of aircraft movements that are taking place today could possibly be handled in the manner he has suggested. Why, it would make today's FAA staff look like a frail skeleton force.

Mr. Davis' references to what he calls "air discipline" are just another way of describing how you would go about wiping out the entire U.S. civil aviation industry as we know it today. Can you imagine a typical average man, who has bought, say, a $20,000 private airplane, being subjected to the kind of regimentation Mr. Davis apparently takes for granted? We can always go back to the analogy of the automobile. A proposal like Mr. Davis' surely would eliminate a very substantial percentage of the 30,000-odd fatalities we have on our highways every year. But why isn't it done? And if it were done, what do you think would happen to the automobile industry? And the highway building industry? And the gigantic servicing industry that takes care of the automobile?

It is quite true that the great majority of all accidents are "pilot caused," as Mr. Davis points out. That's because—no matter what the supermen think—pilots always end up being mere human beings. And the best example of this are the Air Force and Navy themselves, where these super-regimented professional pilots turn in a hair-raising accident record each year, despite all the regimentation Mr. Davis advocates. This leaves him with only one comeback: "Imagine what that accident rate would be without that regimentation!"

No matter what system you design, you're always going to end up having trouble with the human being involved. Still fresh in my mind is a midair collision between two B-52's while circling in the traffic pattern of a West Coast Air Force base not long ago. It cost the taxpayers many millions of dollars, and lost a lot of lives—all unnecessarily. Both of those aircraft had the most experienced professional pilots that money can train, the equipment was the best that money can buy, and they were under the control of a traffic control system that lacks nothing.

MAX KARANT
Vice President
Aircraft Owners and Pilots Assn.
Washington, D. C.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Proper Solution

Recently, I had occasion to read copies of your magazine dated Nov. 10 and 17.

Of particular interest in the Nov. 10 issue is "Cockpit Viewpoint" (p. 43). Paragraph two is written in such a nature that I am forced to take violent exception to the statements contained therein. Unless Capt. Robson has closed his eyes to all the various conversations concerning controlled IFR during the past few years, he must know that there is considerable opposition to a 100% IFR system.

I would not in any way mean to imply that Capt. Robson is not to be given the right to "freedom of the press." The only point to be made here is that in such an authoritative journal as yours, the public expects facts, and if these facts are on both sides of an issue that they be so stated. It is a well-known fact that all airline pilots and the military would prefer to have 100% IFR. It is also a well-known fact that general business and pleasure flying can see little or no justification for such a system. I might also make the point that general business and pleasure flying is in the air twice as many hours as the airlines, and own many times the number of airplanes.

In your Nov. 17 issue under "Airline Observer" (p. 45) there is also an interesting paragraph concerning the Air Line Pilots Assn. In this case the ALPA, whose viewpoint is always publicized by Capt. Robson, is unhappy to the point that they have passed a resolution authorizing legal action, if necessary, to ensure that any agency charged with air traffic control responsibility will not adopt any procedures that could deny turbojets the use of available airspace. The ALPA is quick to voice its feelings whenever it is not satisfied, and it should understand that other organizations of the flying world may do the same. If such a resolution was passed concerning turbojet operations, we of the general business and pleasure flying public would have every right to insist on legal action concerning our rights.

It would appear that what is needed here is some moderation and common sense. Only in this way will we have regulations concerning flying which will satisfy all parties involved. I hope that your magazine will help lead the way toward a proper solution in these issues.

WILLIAM A. THOMAS, II
Pittsburgh, Pa.

THE MAN WITHOUT FEAR

Before dawn on June 2, 1917, a gutty Canadian pilot hedge-hopped his silver Nieuport behind enemy lines to attack a German airdrome single-handedly. He destroyed three Albatros biplanes—bringing

(Continued on page 68)

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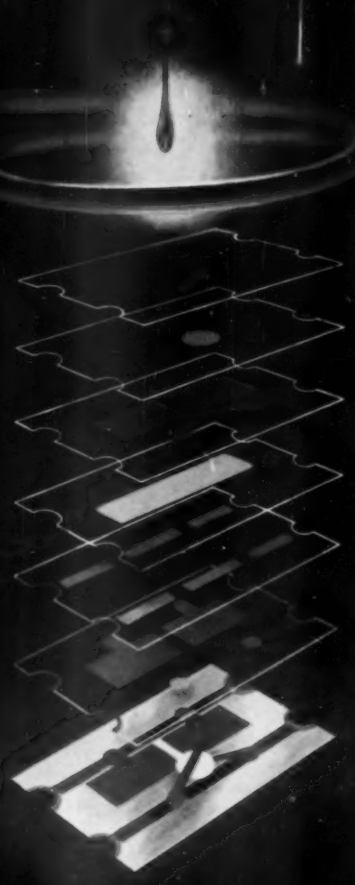

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